Agricultural Outlook Forum 1999

Speech Booklet 2

Tuesday, February 23
For release 7:00 a.m., February 23

8:00 - 9:30 GRAINS AND OILSEEDS OUTLOOK

Utterback Marketing Services, Inc.'s 1999 Market Outlook
Robert L. Utterback, President, Utterback Marketing Services, Inc., and Farm Journal Outlook Editor

8:00-9:30 USING RISK MANAGEMENT FOR ENVIRONMENTAL IMPROVEMENT

Promoting Conservation Innovation in Agriculture Through Crop Insurance
Jim Cubie, Director, Agricultural Conservation Innovation Center

Creating a Market for Carbon Emissions: Opportunities for U.S. Farmers
Richard L. Sandor, Chairman and CEO of Environmental Financial Products, L.L.C, and Jerry R. Skees, Professor, Department of Agricultural Economics, University of Kentucky

10:00-11:30 NORTH AMERICAN LIVESTOCK AND POULTRY OUTLOOK

Canada's Outlook for Livestock and Poultry
Stèphan Gagnè, Research Economist, Economic and Policy Analysis Directorate, Agriculture and Agri-Food Canada

10:00-11:30 PANEL: COMPETITION FROM LATIN AMERICA

South American Infrastructure Improvements
Gregory L. Guenther, Director, National Corn Growers Association

Evolution of Agricultural Production in Latin America
Dr. Michael Cordonnier, President, Soybean & Corn Advisor, Inc.

10:00-11:30 OUTLOOK FOR EMERGING TECHNOLOGIES IN THE SUGAR INDUSTRY

Ag Outlook 1999
Thomas K. Schwartz, Executive Vice President, Beet Sugar Development Foundation

10:00-11:30 BRIEFING ON THE RETAIL FOOD PRICE OUTLOOK

The Outlook for Food Prices in 1999
Annette L. Clauson, Agricultural Economist, Economic Research Service, USDA

12:10-1:30 SWEETENERS LUNCHEON

Sweeteners Industry Trade Policy issues on the Horizon–Dangers, Opportunities
Jack Roney, Director of Economics and Policy Analysis, American Sugar Alliance

12:10-1:30 GRAINS AND OILSEEDS LUNCHEON

State of the Farm Economy: How Good or How Bad?
Abner W. Womack, Co-Director, Food and Agricultural Policy Research Institute

1:45-3:35 PROSPECTS FOR CHINA: IMPORTER OR COMPETITOR?

China's Food Supply, Demand, and Trade in the 21st Century
Scott D. Rozelle, Associate Professor, Department of Agricultural and Resource Economics, University of California, Davis

UTTERBACK MARKETING SERVICES, INC.'S 1999 MARKET OUTLOOK

Robert L. Utterback
Farm Journal Outlook Editor
Utterback Marketing Services, Inc. President

Before I discuss my 1999 price outlook for grains and oil seeds, I would like to thank Jerry Rector, Raymond Bridge, and the World Agricultural Outlook Board for the opportunity to speak to you today. My primary audience is usually producers, so many of you may not recognize me. Since early 1980, I've been helping farmers throughout the United States develop and implement marketing plans for merchandising their products throughout the U.S. Currently as *Farm Journal's* outlook editor, I have sought to help producers understand the marketing issues facing them. I am also president of Utterback Marketing Services, Inc., a full-service brokerage office. We develop strategies for grain and livestock producers. And as brokers, we actually enact the strategies for our clients. We have to deal on a daily basis with the consequences of being wrong!

A wave of anxiety about prices is washing over everyone from the producer to the banker to the local implement dealer. We've talked with farmers throughout the Midwest the last few months. Those attending meetings we spoke at are not a scientifically chosen sample, but we think the producers at these meetings--from Lafayette, Indiana, to Grand Island, Nebraska--are representative of the overall farm population. Their two most frequent questions were, What can I do about old- and new-crop corn and soybeans? and Is the Freedom to Farm Act the farmer's friend or foe? Time only permits me a discussion of the first question, I hope to hear from many of you about the latter.

What will old- and new-crop prices do? Well, let's start with corn, and consider the near-term and potential future fundamentals.

CORN SUPPLY AND DEMAND	96/97	97/98	1998/99 DEC.	1998/99 JAN.	1998/99 FEB.	
PLANTED	79.5	80.2	80.8	80.2	80.2	
HARVESTED	73.1	73.7	73.8	72.6	72.6	
YIELD PER HARVESTED ACRE	127.1	127	133.3	134.4	134.4	
BEGINNING STOCKS	426	883	1,308	1,308	1,308	
PRODUCTION	9,293	9,366	9,836	9,761	9,761	
IMPORTS	13	9	10	10	12	
SUPPLY,TOTAL	9,732	10,258	11,15	11,079	11,081	
FOOD	5,302	5,505	5,850	5,700	5,700	EXP UP 50
FOOD/SEED/INDU.	1,692	1,782	1,880	1,870	1,870	
DOMESTIC USE	6,994	7,287	7,730	7,570	7,570	EXP 7,620
EXPORT	1,795	1,504	1,700	1,700	1,725	
TOTAL USE	8,789	8,791	9,430	9,270	9,295	EXP 9,345
ENDING STOCKS	883	1,308	1,724	1,809	1,786	EXP 1,736
CCC INVENTORY	2	4	4	5	12	
FREE STOCKS	881	1304	1,720	1,804	1,774	EXP 1,724
OUTSTANDING LOAN	179	310	325	325	325	
AVERAGE PRICE	$2.71	$2.43	$2.00	$1.95	$1.95	

SOURCE: USDA

The only figure we really would take exception with is the 150-million-bushel reduction in the feed-usage estimate between December and January. We think that's mostly based on the assumption that livestock herds are not going to be reduced as fast as anticipated. Recent government efforts to help hog producers, and the rally above the $40 (live weight) break-even level by the deferred hog futures, have encouraged producers to modify or postpone their decisions to liquidate. We fear the herd liquidation figure in the April hogs and pigs report will fall short of the 6.5% level indicated in the December report and well below the 8 to 10% currently being discussed by the trade. That leads us to conclude that the feed-usage drop the USDA has anticipated will be limited. We do recognize the competition on the Western plains from wheat on feed utilization--which is so good and cheap that many producers in Nebraska tell us feedlots are simply not interested in their corn. We would be more comfortable with at least 50 of the 150-million-bushel feed reduction creeping back, raising feed use to 5.750 billion bushels; that would make total usage 9.345 billion bushels, and drop carryover to 1.736 billion. Some would say this is nit picking since it will most likely not be enough to change the growing negative attitude of the market. We just want to start our 1999 projects with as good a number as possible.

Three Possible Acreage Projections For Corn. Let's consider three possible acreage projections for corn for direction, that should be resolved by the March 30 report. In one, acreage is down 1.5 million from last year's final planted numbers, due to production problems outside the traditional Corn Belt--such as in the South--caused by drought or disease. In the second, that drop in the South is partly offset by winter wheat acres moving to corn acres in the Midwest; making for a net corn-acreage drop of about 800,000 acres. Then there's a possibility that's more bearish yet: The reduction in the South is less than anticipated since cotton prices are under pressure, the winter wheat acreage goes heavily into corn because of rotation and low soybean prices encourage more corn planting elsewhere. Here's something for the bulls to consider: In the end, bullish hopes could be blown up by a limited drop in total acreage plus the addition (not loss) of more productive acres in yield, with an end result of a limited drop in production.

As for where we stand, early this year we thought that the acreage drop would be less than the trade projected, but recent discussions with Western producers have changed our thinking. We now feel there is going to be a push to rotate acreage that has been in continuous corn, and plant some beans. We now think the March 30 USDA report will project a drop in corn acreage of more than 800,000 acres. Please note that our hunch is, if December corn futures are trading at $2.40 or higher at planting and November soybeans is at $5.20 or lower, the March 30 projected acreage number could turn out to be the lowest of the year for corn. In our opinion the incentive to plant soybeans will not be as attractive, and growers will likely plant more corn, if weather permits.

1999 UMS CORN - WHAT IF?

	1999 PROJECTIONS		
	ACRES	ACRES	ACRES
	Dn1.5	Dn.8	Up.6
PLANTED	78.7	79.4	80.8
HARVESTED 92% OF PLANTED	72.4	73.0	74.3

Our working assumption going into this year is that it's going to be more difficult to get a yield loss due to weather influence because of where the crop is produced. Without a major dry weather event (some are saying it has the potential of over 40%), we feel the potential exists, with moisture already rather good, to have yields at trendline plus.

With acreage down just modestly, we believe the only potential price-rally engines should be lower yield or stronger demand. The producers are starting to realize this and that is why they are getting scared.

We'll start with yield. There are two things to consider first: Good late-fall weather allowed producers from Ohio to Nebraska to get a lot of their tillage and pre-planting work done, and producers' concerns about late-summer La Nina weather trouble will likely drive them to plant both corn and beans EARLY and HARD if they don't have a wet spring. We would also suggest a positive impact of the Freedom of Farm has been the implementation of a good 50-50 rotation mix of corn and beans. The end result is acreage is more rested and recharged to increase the corn production potential. To get an idea of the range of possibilities, let's consider three scenarios. In the first, delayed plantings and significant summer weather trouble cut yield 15% reduction from the 134.4 bushels an acre of 1998--along the lines of the 18.1% drop of 1995, not near the 1983 reduction of 28.4%, the 1988 reduction of 29.4% or the 1993 reduction of 23.4%. Frankly, if seriously projecting a yield drop that great, my best recommendation for the producer might be not to plant. Any producer will tell you he would prefer big production and low prices to low production and high prices.

The second scenario is of **a typical year, with yield reaching the average of the last three years'**--though we believe the result is slightly low, given the possibility that better-producing acres will be substituting for some worse-producing ones this year.

Finally, let's consider **a modest yield increase of 2.5% from last year's level**; that would still leave it short of 1994's record yield of 138.6 bushels an acre, which we all know will be exceeded one of these years.

1999 UMS CORN - WHAT IF?

	1999 PROJECTIONS		
YIELD PER HARVESTED AC.	114.2	129.4	137.8
BEGINNING STOCKS	1,736	1,736	1,736
PRODUCTION	8,269	9,452	10,244
IMPORTS	12	10	10
SUPPLY,TOTAL	10,015	11,198	11,990

So our three scenarios suggest corn supply of 10 billion to 12 billion bushels for the 1999 season. Let's consider three demand scenarios as well.

1999 UMS CORN - WHAT IF?

	1999 PROJECTIONS		
FOOD	5,600	5,775	5,850
FOOD, SEED/INDU.	1,776	1,924	1,964
DOMESTIC USE	7,376	7,699	7,814
EXPORT	1,587	1,776	1,863
TOTAL USE	8,963	9,475	9,650

The demand side of the equation is more difficult to predict for 1999. Our opinion is biased since we work with the producer rather than the end user; but we suggest the following as starting points. On feed consumption, the first, low estimate assumes that higher grain prices and continued herd liquidation reduces demand-- down 1.7%, the second that consumption goes up 1.3% and the third that it goes up 2.6% because hog producers expand. The first industrial usage estimate represents a 5% drop, just as we saw in 1995. The second, likelier one is for a gain of 3%, a conservative increase based on the assumption that lower prices will stimulate usage. The third reflects a 5% increase, along the lines of what we saw in 1994, 1996 and 1997.

Exports are the big unknown and where we need the growth to change the bears' grip on the market. Did low 1998 hog prices force liquidation outside the U.S., which could reduce the demand for feed grains globally? What effect will a weaker dollar have? Will there be a surprise government program to stimulate usage as the 2000 election nears and political pressure mounts? Add these background uncertainties to exports' tendency to leap and dive, and you see the difficulties. The last three years have all brought double-digit changes: A 19.4% drop from 1995 to 1996, a 16.2% drop from 1996 to 1997 and a 13% rise from 1997 to 1998. And it's only a few years since the 63% jump between 1993 and 1994. To say the average change over the last five years has been 8% really doesn't do these gyrations justice. Still, we must make a projection just the same: a 3% increase for the mid-range, flanked by an 8% decline and an 8% increase.

The result: Our total usage estimates range from 8.963 billion bushels to 9.650 billion.

1999 UMS CORN - WHAT IF?

	1999 PROJECTIONS		
ENDING STOCKS	1,052	1,723	2,340
CCC INVENTORY	12	12	14
FREE STOCKS	1,040	1,711	2,330
OUTSTANDING LOAN			
STOCKS TO USE	12%	18%	24%
U.S. AVERAGE YEARLY PRICE	$2.50	$1.95	$1.50

And there we have an answer to the question about corn prices.

So if acres are dropped at least 1.5 million and we have one of the largest year-to-year drops in harvested yield, and demand declines only modestly, we feel the best we can hope for in 1999 is that stocks reach a reasonable 1.053 billion bushels, which would set things up nicely for a summer bounce in 2000--driven by weather or politics. The mid-range estimates lead to a carryover of 1.7 billion bushels, just slightly less than where it is now. Still, we project a yearly price about 10 cents lower than in 1998, based on an uncertain international economy and bearish pressure from wheat and beans.

Then there is the third possibility: no reduction in planted acres, increased yield and only modest demand growth. If these come to be, free stocks could reach their highest level ever, and prices could drop to levels not seen since the 1960s. We hope to see the first alternative, and my fear the latter.

UMS Assumptions for 1999:

- Producers will sell only limited amounts of their unpriced loan deficiency payment inventory before March 1.

- Producers will put inventory under loan and try to starve the market this spring.
- Elevators will offer free deferred pricing or allow producers to deliver summer forward contracts in April and May, which gets the inventory the end user needs met at this time.
- USDA's March 30 prospective plantings report will forecast a modest decline in corn acreage, but will eventually end up below a one million acre reduction.
- Mid-May will be a key period for the market. If the May 10 crop progress report doesn't show signs of delayed planting, and the May 12 supply/demand report doesn't show higher usage, any spring rally will grind to a halt.
- Adequate soil moisture means weather-related crop difficulties, if they come at all, will be late like 1983.
- The loan deficiency payment will be a critical part of any profit from the 1999 crop. Please note that, if USDA is to maintain any credibility with the producers in the new age of the farm program, we cannot emphasize strong enough the LDP payment differentials not be played with to reduce potential budget exposure and subsequently reduce farmer payments.
- It is our belief that producers must be alert to defend against a 1998-style early harvest low and fall recovery influence on their LDP payments.

We start with the assumption that producers who made use of the loan deficiency payment program last fall did little in the way of pricing. The price was too low to motivate selling, and many producers still don't understand the implications of a large-carrying-charge market. The result is that a tremendous number of producers are still holding unpriced inventory. Current prices represent a loss for them, and my years of working with producers tell me they are not going to let go of the inventory. It should be noted that we do not believe farmers will store as aggressively in 1999 as they have over the last three years. This belief is based on the assumption that, if prices are under pressure, bankers will want loans cleaned up, as well as the significant amount of short interest in the grain elevators.

As for the near future, we expect a short-covering rally to develop gradually as March 30 approaches. In our opinion it will be more in the deferred than the nearby contacts. End users, scrambling for inventory, will likely buy the March futures and force delivery, which could also help to rally the market. We feel the March 30 report will confirm an acreage reduction, setting the stage for a flat-price rally in April and May; the extent of the rally will heavily depend on the incidence of planting delays. Producers will likely continue to sit on their crops, leaving the market cash-starved. We believe there will be a key stretch of days in mid-May for producers to watch. If the May 10 crop condition reports that plantings are at or above the five-year average and no significant delay-causing rain is expected, prices of deferred futures will start to soften. In our opinion, May 12th will be D-Day for 1999 marketing decisions; if the supply/demand report shows no sign that lower prices are creating significantly higher usage, the market will have no alternative but to send prices for deferred contracts lower, with the downward momentum increasing as crop progress continues.

In our opinion, the critical variables for corn are when producers sell corn, how many acres they plant, how livestock production holds up, how much is exported and, the big wild card, whether the government tries to stimulate demand or change policy on the use of LDP.

SOYBEAN SUPPLY/DEMAND	1996/97	1997/98	1998/1999 JANUARY	1998/1999 FEBRUARY
AREA				
PLANTED	64.2	70.6	72.4	72.4
HARVESTED	63.4	69.6	70.8	70.8
YIELD PER HARVESTED ACRE	37.6	38.8	38.9	38.9
SOURCE: USDA				

In the past many producers counted on soybeans to be the mortgage lifter, and this year they want to know if they can count on the price hitting $6.50 again. Well, let's look at the numbers, starting with supply.

BEGINNING STOCKS	183	132	200	200
PRODUCTION	2,380	2,689	2,757	2,757
IMPORTS	9	5	6	6
SUPPLY,TOTAL	2,573	2,826	2,963	2,963
SOURCE: USDA				

Essentially, we have no quarrel at all with this side of the February report. The working supply is expected to be a relatively modest 4.8% larger than last year's -- but 15% larger than that of two years ago. Is demand going to keep up?

CRUSHING	1,436	1,597	1,595	1,595
EXPORTS	882	870	830	810
SEED	83	86	87	87
RESIDUAL	42	86	61	65
TOTAL USE	2,443	2,626	2,573	2,553
ENDING STOCKS	131	200	390	410
AVERAGE FARM PRICE	$7.35	$6.45	$5.35	$5.20
SOURCE: USDA				

In our opinion, no -- clearly, demand has fallen on hard times. Total use was projected at 2.573 billion bushels in the January report, the February report indicated a reduction in exports (as expected), which reduced use to 2,553. In fact, by the time we get to fall, we expect the carryover projection may well be higher than the current 410 million bushels. But for the sake of our "what if?" analysis, we will use 410. It is over three times the carryover of two years ago, and twice that of last year, and will result (USDA estimates) in an average price that's down 29% from that of two years ago and 19% from that of one year ago. The nagging question, with potential for large carryover, how low will prices have to sink before usage is stimulated and acreage is reduced here and abroad?

1999 UMS SOYBEANS - WHAT IF?

	1999 PROJECTIONS UNCHANGED	UP 1.75 MIL.	UP 2.75 MIL.
PLANTED	72.4	74.2	75.2
HARVESTED @ 98.35%	71.2	73.0	74.0
YIELD PER HARVESTED AC.	32.7	38.5	39.5

Whether you want to argue soybean prices higher or lower depends heavily on your assumptions about bean acreage. We believe strongly that they're going up; the question is how much?

Consider the economics of the corn, wheat, cotton, and bean loans versus cash flow; beans are getting the nod by many producers. Finally, consider the pressure from bankers to reduce risk this year; beans are a favorite of producers. In our opinion, the conclusion is clear for producers: PLANT BEANS. What we're hearing about seed sales, especially in the western states supports this. Indeed, with the reduction in wheat acreage in the western states, we really believe there is a risk in being too conservative in forecasting bean acreage.

So we don't even consider the possibility that acreage will decline for 1999; our most bullish forecast is based on no change. Our midrange forecast assumes an increase of 1.75 million acres, and our most bearish an increase of 2.75 million.

As for the yield, let's assume for the low end a drop of 15% from last year's, to 32.7 bushels an acre, the lowest since flood-struck 1993, but far better than the 27 bushels of drought-struck 1988. That decline is just a bit short of the 16.37% average of the last four bad-weather years: The 1983 drop was 16.8%, the 1988 was 20.3%, the 1993 was 13.3% and 1995 was 14.7%. Remember that the seed plasma is better and producers are better equipped to get the crop in and out quicker.

1999 UMS SOYBEANS - WHAT IF?

	1999 PROJECTIONS		
	UNCHANGED	UP 1.75 MIL.	UP 2.75 MIL.
BEGINNING STOCKS	410	410	410
PRODUCTION	2,340	2,810	2,921
IMPORTS	8	8	8
SUPPLY,TOTAL	2,758	3,228	3,339

So the total supply for 1999 is projected to range from 2.76 billion to 3.3 billion bushels. With supply growth of this magnitude, préssure should be on the demand side to show major growth.

1999 UMS SOYBEANS - WHAT IF?

	1999 PROJECTIONS		
	UNCHANGED	UP 1.75 MIL.	UP 2.75 MIL.
CRUSH	1637	1670	1675
EXPORTS	850	880	910
SEED	90	91	91
RESIDUAL	59	59	59
TOTAL USE	2609	2673	2735
ENDING STOCKS	144	555	604
AVERAGE FARM PRICE	$6.75	$4.48	$4.20

Again the demand side of the equation is where we feel the weakest is in our projections, but we're going to assume the best possible. The crush estimates suggest strong demand for oil, so our worst case scenario is that crush will be unchanged. Our mid-range is for a 3% rise, and the best case is an 8% rise to 1675 million bushels. History suggests we must assume a generous jump in export levels; but we're having trouble increasing substantially because of our concern about the currency devaluation wave, which washed over much of Asia in 1997 and hit Brazil just recently. In our opinion China is the big wild card in the export situation. Do they devalue their currency or put up trade barriers to protect their export market share? Again, government policy--both domestically and internationally--will become the wild card that will act to change today's estimates in the future for better or worse. **We're wondering if policy makers can stay out and allow prices to go into a steep decline in order to stimulate use and reduce**

production, or will political pressure increase to such a point that it will force a policy aimed at softening the negative impact of lower prices before next year's presidential election?

OUR ASSUMPTIONS FOR 1999 REGARDING SOYBEANS:

- Acreage will grow by at least 1.75 million acres, maybe more.
- Demand will respond to lower prices, but not fast enough to match the increase in production.
- Result: Carryover could potentially grow to a level not seen since 1985 and maybe to record highs.
- In our opinion only major government demand stimulation can prevent prices from moving well below the variable cost of production. We expect the average yearly U.S. price to be below $5 for the first time since 1975.

So the working assumptions behind our 1999 marketing plan have been that production will rise faster than demand, allowing carryover to grow to historically high levels. We believe producers are still hopeful that significant policy changes will occur to save the 1998 season, but we ourselves are not -- we don't see the government acting, if at all, until after the 1999 crop is confirmed.

Given a potential 47% increase in carryover, how much of a price decline will it take to stimulate usage and discourage production? Unfortunately, we think it will require at least 14% -- which would mean a yearly average price of $4.48 -- and that there's a real risk it will take 19%, which would mean a yearly average price of $4.20! That would explode the government's LDP price payments.

Please note that many producers are wondering whether the USDA would play with the LDP differentials to keep government exposure cost down. It seems they are just now becoming aware of their downside risk exposure.

SUMMARY

We expect:

- A modest reduction in corn acres and a major increase in soybean acres.
- Not enough immediate demand growth for feed grains and oilseeds to prevent significant carryover build-up.

We believe:

- The degree of price risk depends on whether government policy allows a free fall in prices to develop, causing inventory to move and acres to be reduced.
- There are still opportunities for producers to grab a profitable price for their corn, but the soybean market is unlikely to offer anything better than MARKETING LOAN LESS STORAGE COST PLUS OR MINUS BASIS GAIN.
- The loan deficiency payment will be critical to producer survival.

We hope:

- The LDP program will not be influenced to reduce budget exposure.
- Help producers get a bigger piece of the income pie.
- Help to improve farmers' understanding of marketing risk exposure and developing better marketing plans to handle the increased market volatility.
- A review of policy to give some incentive to reduce acres when carryover exceeds 1.5 billion in corn and 350 in beans and 600 in wheat in the 2000 production year.

It has been my pleasure to speak with you about our outlook and our concerns for the 1999 corn and soybean marketing season. We hope that producers will use a spring price bounce to reduce downside price risk; but we're afraid that they will not move fast enough. The clock is ticking, and we may be on the edge of a financially taxing period for the American farmer.

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PROMOTING CONSERVATION INNOVATION IN AGRICULTURE THROUGH CROP INSURANCE

Jim Cubie
Director
Agricultural Conservation Innovation Center

There are many conservation practices that could have significant public benefits. Many of these are not widely used by farmers. Why? One reason is "risk". When a farmer adopts an unfamiliar technology, it raises the risk crop distress. The unfamiliar technology may fail under the conditions found on *his* farm, or weather events may interfere with the new practice.

The Public Problem

In spite of great strides made by the agricultural sector in applying conservation practices, the level of agricultural inputs leaving farmland is still perceived as too high by the public. At the same time, these inputs (soils, fertilizer, and pesticides) are necessary for modern agriculture to operate economically. Recent data shows that farmers also seem to be applying more inputs than seem to be needed for insurance purposes. New nutrient management systems (split nitrogen tests, legume crediting) and various integrated pest management systems that have been recommended by agricultural experts can significantly reduce a farmer's costs. (Input costs are one of the few costs a farmer can control.)

Thus, many of these new nutrient management and IPM systems appear to offer a win-win situation. When the farmer uses them, he cuts costs and the public benefits through less agricultural related pollution.

Unfortunately, the level of use of many new systems is very low. Why is this? It appears that "risk" is a major issue for farmers. Despite efforts to develop management systems to reduce nutrient application, overall fertilizer use in the Corn Belt has not changed in the last decade.

The Farmer's Problem

Farmers have very low rates of return (about 3% on average.) They have good reason to be risk averse. Fertilizers and pesticides are both used by farmers to manage risks or for "insurance purposes". A successful crop may require a certain amount of fertilizer to achieve a certain yield, assuming normal rainfall. Farmers may apply more than the necessary amount for a normal year because it may rain far more than expected. They may also apply more pesticides than are

necessary to control a pest in a normal year because they are afraid that abnormal weather might make their pest problems worse.

Conservation Innovation Risk Management Support

Because of the need to help farmers adopt conservation practices, the development of risk management products for conservation purposes has been supported by a broad variety of organizations. These include:

- American Farm Bureau Federation
- National Association of Wheat Growers
- United Fresh Fruit and Vegetable Association
- VP Gore's Clean Water Plan
- National Audubon Society

BMP/IPM Types of Risk

In fact, farmers face three kinds of risk when considering adoption of any new practice, including IPM or nutrient management practices:

1. Innovation Risk
2. Test-Trust Risk, and
3. Operating Risk.

Innovation Risk:

One barrier to wider use of IPM systems is that the early adopters of the new practice are using a system that has not been tested in a wide variety of commercial farming conditions and therefore is not trusted. For example, a successful Rio Grande Valley, grower told this story illustrating the risk that innovators often face:

> *Professor Smith from the University told me that I was wasting money, spraying fungicides too often. I trusted Professor Smith because he developed a vegetable variety that has been very profitable for me. Professor Smith told me, 'Just put this moisture meter in the soil weekly. So long as the moisture level is below X, you do not need to spray.' I took his advice. For a few weeks, I used my moisture meter, and the reading said, 'No need to spray.' So I did not spray. Each week I watched as my neighbor sprayed. To make a long story short, by the fifth week, I was so nervous that I sprayed, even though I did not need to.*

Test-Trust Risk

It is hard for a farmer to "bet the farm" on a test or procedure, no matter how well established or proven that test may be. The acceptance of corn rootworm scouting procedures and legume and manure crediting illustrate the problem.

Corn rootworm

After years of research, Midwest entomologists have concluded that less than 50% of the soil-applied insecticides used for rootworm are really needed. Currently, the technology exists to scout cornfields (corn after corn), to determine if a corn rootworm insecticide will be needed next year.

Scouting for corn rootworm beetles is done in July and/or August. At that time, a crop consultant can determine the level of beetle infestation and will make a recommendation on whether to "treat" or "not treat" the following spring for corn rootworm. When using proper IPM techniques, most Midwest entomologists believe that if a recommendation to "not treat" is made, there is less that a 5% probability that rootworm damage will occur next year.

IGF's agricultural insurance division will be offering a policy to guarantee a crop advisor's recommendation not to spray for corn rootworm. Under this insurance policy, the farmer will be indemnified if the consultant made a "do not treat" recommendation and an infestation occurred and damage occurred.

Operating Risk

Farmers often apply fertilizer in order to avoid losing N in years of extreme, heavy rains. As a result, most years, when the excess rains do not occur, the excess N does not get used and may affect nearby water resources. There is a need to encourage conservation nutrient management systems. If a farmer were to adopt a split N application system, for example, he would run the risk of not being able to get into his field and apply the second portion of his nitrogen. In fact, according to press reports, the Illinois Extension Service warns farmers against adopting the split application nitrogen management system because of the risk that excessive rainfall will interfere with a second application of fertilizer. ACIC has developed a rainfall based risk management policy to address this risk. The farmer will be indemnified if, indeed, excessive rainfall occurs and prevents the farmer access to fertilize his field.

Research on Risk as a Conservation Adoption Barrier

Numerous studies have found that risk is a major reason that farmers are not adopting technologies, such as nutrient management and IPM, that even the farmers believe are profitable.

A 1995 USDA Economic Research Service Study, entitled "Voluntary Incentives for Reducing Agricultural Nonpoint Source Water Pollution," surveyed a number of farmers to determine why they are not adopting these win-win practices. This study found that although farmers understand the practices, and think they cut costs, they still do not adopt them. In probing further the study found that, with regard to both IPM and nutrient management, "risk" was one of the two principal reasons that the practices are not being used. The study further found that farmers perceive the risk of some conservation IPM or BMP practices to be as high as 70-80%.

A second recent National Academy Report entitled Ecologically Based Pest Management, reached similar conclusions. It found:

> *The interaction of economic feasibility and risk largely determines the likelihood that an ecologically based pest management system will be adopted or implemented by growers.*

Commercial Risk Management Products for Coming Crop Year

Two major insurance companies will offer pro-conservation policies created by ACIC, a non-profit partner with NRCS and EPA.

Innovation Risk

Promoting Agricultural Conservation Innovation Policy

> Local organizations, such as Mississippi Conservation Districts and Campbell's Soup have insured farmers to increase adoption of BMP and IPM practices. The need for adoption of innovative conservation systems is large, and providing insurance for even a small number of farmers can tie up a large amount of local conservation funds or cost a local entity dearly if a particular experiment fails. So that local organizations do not have to develop insurance policies for innovators, ACIC has proposed the development of a "Conservation Innovation Risk Policy." Under the policy, a sponsoring conservation organization can obtain for a farmer an "Innovation Insurance Contract." The insurance contract will provide protection for "split field" demonstrations. The farmer will be guaranteed that the field using the innovative practice will not have a significantly lower yield than a comparable field using standard practices. IGF has agreed to offer these policies next crop year. Startup funds have been secured from a private foundation.

Test Trust Risk

Corn Rootworm IPM Policy

> IGF Insurance, Inc. will be offering a corn rootworm policy that will insure farmers against the infestation of corn rootworm. This policy will permit a farmer to rely on the advice of an expert who will utilize approved scientific procedures to the soil and then advise him to spray or not to spray. The farmer then can trust the test and follow the scouting advice. If the infestation occurs and the corn rootworm is present after the consultant's advice not to treat, the farmer will be indemnified. The indemnity may pay for a rescue spray. It will also be adjusted using a yield loss predicting test, similar to the way hail policies are adjusted.

Operational Risk

Cold Soils No-Till Policy

American Agrisurance has developed a policy that will protect farmers against a "cold soils" period, which is slowing and in some cases reversing "no-till" adoption in the Corn Belt. It has been developed in cooperation with major ag-chemical suppliers and National Tilth Lab and the Conservation Technologies Information Center out of Purdue University. In the spring, farmers who wish to operate no-till systems run the risk of cold soil, which stunts the growth of their crop. The proposed insurance policy would indemnify farmers if the soil was too cold and prohibit planting during the early spring planting period. How the policy will be offered is now under consideration.

Nutrient and Atrazine Risk Management Policy

American Agrisurance, Inc. will be offering a rainfall-based policy, which will address the risk of split nitrogen application. The "rainfall policy" is designed to compensate for times when a split application is not possible due to excess rain after planting. For some farmers using split fertilization practices, the policy would pay for itself in nitrogen savings alone. The product should also increase adoption of post-emergent weed products which will displace Atrazine use. Several post-emergent weed control products only achieve maximum control when applied in a very narrow window of time.

Other Commercial Products Under Development

In addition to the three products that will be commercially available next year, at least one other clean water promotion policy is at final stages of development. Several others are in early stages of development.

Potato Late Blight Policy

This policy permits farmers to follow "wait until fungus conditions exist" announcement made in Wisconsin and North Dakota potato production. By spraying after this recommendation is made, the farmer has could possibly avoid 1-3 fungicide sprays per season.

Other IPM Products Under Development

In addition to the IPM related products that will be offered next year, six more IPM products are expected to be commercially available the following year.

National Nitrogen Deficit Insurance Policy

Agriculture's toughest challenge is the effect of nutrient (N and pH) on water quality. A joint public-private effort should be launched to develop the actuarial basis and adjustment systems to make such a contract possible. Without it, significant reductions in nutrient use are very unlikely for economic reasons. ACIC has developed a strategy

document that outlines what needs to be done to develop a nitrogen management policy. Please see our website for a copy of this material.

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This Article Will Appear in the 1st Quarter Issue of *Choices*: A Magazine published By the American Agricultural Economics Association

Much of this will be presented at the Agricultural Outlook Forum 1999 on Tuesday, February 23, 1999 by Jerry R. Skees.

EXECUTIVE SUMMARY AND KEY WORDS

Creating a Market for Carbon Emissions: Opportunities for U.S. Farmers

Richard L. Sandor and Jerry R. Skees*

This article examines the role that U.S. farmers could play in reducing greenhouse gases – a major international objective. Using the market to trade sulfur emissions has been a large success in the U.S. Likewise, a worldwide market for carbon emissions could help reduce greenhouse gases in a more cost-effective fashion than command and control systems. U.S. farmers could be big winners from such a market as they are uniquely positioned to sequester more carbon by adopting more Best Management Practices (BMPs). Adopting more BMPs has the dual effect of cleaning the global and the local environments.

Keywords:

Carbon Trading, Kyoto, Green Support Payments

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Bio of Authors

Richard L. Sandor is Chairman and Chief Executive Officer of Environmental Financial Products, L.L.C. and visiting scholar at the Kellogg Graduate School of Management Northwestern University. This firm specializes in providing consulting, financing and trading of environmental markets. Dr. Sandor is widely recognized as a founder of the interest rate derivatives markets now traded worldwide, and has designed revolutionary market mechanisms for the catastrophe insurance industry and market-based solutions to environmental problems. Dr. Sandor is known for founding the Chicago Board of Trade sulfur dioxide emission allowance market. He was also the originator and co-author of the catastrophe and crop insurance futures and options contracts. He has advised leading exchanges, governments, international agencies and corporations around the world on the design and implementation of a market for greenhouse gas emissions. Dr. Sandor currently also serves as Chairman of Hedge Financial, a unit of CNA Insurance, and is Second Vice Chairman of the Chicago Board of Trade and a member of the boards of directors for the following organizations: Central and South West Corp., a Dallas-based public utility, the Center for Sustainable Development in the Americas, and Zurich-based Sustainable Asset Management.

Jerry R. Skees is a teaching and research professor of policy and risk in the Department of Agricultural Economics, University of Kentucky. While Dr. Skees has been at the University of Kentucky since 1981, during this time he has also gained experience working in Washington D.C. and in the private sector. In 1989, Skees was the research director for the Commission to Improve the Federal Crop Insurance Program and a visiting scholar at the Economic Research Service – USDA. For the last several years, Skees has consulted with the U.S. government, the World Bank, and private firms in the capital markets. In addition to authoring numerous scholarly journal articles, Skees is co-author of the award-winning book – "Sacred Cows and Hot Potatoes: Agrarian Myths in Agricultural Policy." He is also a recent recipient of the Outstanding Teacher award from the Southern Agricultural Economics Association.

Creating a Market for Carbon Emissions: Opportunities for U.S. Farmers

Richard L. Sandor and Jerry R. Skees*

Reducing greenhouse gases has become a major international objective. While the international community debates the Kyoto protocol, a number of countries have already announced that they will reduce greenhouse gases. The November 1998 Buenos Aires meeting on the Kyoto Protocol helped advance the trading approach as one means for reducing greenhouse gases. Since carbon dioxide is a major greenhouse gas, creating a market for carbon emissions is under consideration. Should such a market evolve, U.S. farmers could be big winners.

Even though some in the scientific community do **not** believe carbon emissions contribute to global warming, everyone agrees carbon emissions are increasing rapidly. Since it is possible that carbon emissions increase the likelihood of significant climate change, a market should be at the top of the list of policy options to cost-effectively manage emissions. In effect, a carbon trading system may be cheap insurance against potentially large societal problems.

Sulfur Emissions Trading Paves the Way

Emission allowance trading is a straightforward concept that is already operational on a national scale. The U.S. sulfur dioxide emissions market provides a good example. Congress placed an overall restriction on power plant emissions nationwide, effectively allowing power plants to comply by either 1) investing in cleaner fuels or pollution control technologies or 2) buying extra emissions rights from another power plant that made extraordinary emission cuts. Buying excess rights from a more efficient power plant allows the older and less efficient plant to meet its obligations at lower cost to consumers. In short, trading emissions permits allows industry to meet emissions goals in a least cost way.

Title IV of the 1990 Clean Air Act Amendments cleared the way for trading sulfur emissions among 110 power plants. During the debate on this legislation, experts estimated that these emission rights would command a very high premium. Some initial estimates ran as high as $1500 per ton. Hahn and May report several pre-1992 estimates of forecasted per ton prices for sulfur emission allowances, ranging from $309 (Resource Data International) to $981 (United Mine Workers). In 1998, the Chicago Board of Trade (CBOT) auctioned off a large number of allowances at an average price of $115. Carlson et. al. argue that many factors, in addition to trading of emissions rights, created low prices of sulfur emission allowances: improved technologies for burning low sulfur coal, improvements in electrical generating efficiency, and lower fuel costs.

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Evaluations of the sulfur emissions trading program suggest that it has been a success. By 1998 actual sulfur emissions averaged 30 percent below the allowable level. There has also been steady growth in the inter-utility trading of allowances from 700,000 tons in 1995 to 2.8 million in 1997. The full effects of the trading have not been realized as the market is still adjusting to this new innovation. Carlson et. al. estimate that this innovation will save $784 million annually beginning in the year 2000. Further, they estimate the net cost of the cap and trade system is 43 percent of the estimated costs under a command and control system.

The Potential of Carbon Trades for U.S. Agriculture

If a market evolves for greenhouse gas emissions, those who are now contributing to carbon emissions may be willing to pay others to sequester carbon (remove it from the atmosphere) as a permanent offset to emissions, or as a means of buying time to invest in technologies needed to reduce emissions. When sequestering carbon costs less than reducing carbon emissions, the carbon market would provide a more efficient solution. Firms would likely use a combination of reductions in emissions and offsets with carbon trades.

A market would also motivate technological improvements to both sequester carbon and reduce emissions. For example, if prices signal farmers to sequester additional carbon, the market would respond with new technologies. Price incentives would encourage bio-engineering plants that more efficiently and effectively sequester carbon. Most soil organic carbon is in the upper meter of soil. Could plants with deeper roots sequester more carbon to deeper levels?

The agricultural sector provides a number of effective alternatives for sequestering carbon. Forests and cropland offer the most promise. A large number of solutions will be needed to offset the increase in carbon emissions, and a market offers the best way to orchestrate them. Agronomists (Lal et. al) estimate the overall potential for carbon sequestration using U.S. cropland at 120-270 million metric tons of carbon per year (MMTC/yr). Around 100 MMTC/yr would come from increased use of Best Management Practices (BMPs). The remainder comes largely from acreage conversion and bio-fuels. Worldwide carbon emissions are growing by about 3,000 MMTC/yr. The U.S. emissions target under the Kyoto protocol is roughly 600 MMTC/yr below the level projected by 2010 under current trends. Thus, U.S. cropland could be used to reduce the projected annual world increase in carbon by about 7 percent, or about 30 percent of the U.S. share under the Kyoto protocol.

Most soils have a capacity for sequestering additional carbon. Tilling the soil, however, releases carbon into the atmosphere. Lal et al. report that Corn Belt soils likely have about 61 percent of the carbon that was present in 1907. Minimum and no-till systems can sequester more carbon. In 1997, about 37 percent of the arable land in the U.S. was under conservation tillage. Lal et. al estimate that using more BMPs (primarily reduced and minimum tillage systems) could sequester 5000 MMTC in cropland soils

over the next 50 years. That converts to 100 MMTC/yr via wider use of BMPs, while other options offer the possibility of up to an additional 100 MMTC/yr.

Estimates of the value of carbon emissions allowances range from $15 per ton (Council of Economic Advisers) to $348 per ton (Energy Information Administration). Based on early market signals, Environmental Financial Products is using market values between $20 and $30 per ton of carbon. Without a market to trade carbon emissions, the lower prices (and the lower mitigation cost to society) will not be possible.

Using the low-end estimates of $20 to $30 per ton, paying farmers to sequester 200 MMTC/yr could add $4 to $6 billion of gross income to the farm economy – and possibly up to 10 percent of typical net farm income. The market for carbon could be a major supplement to the Conservation Reserve Program and, if managed properly, opportunities in the international carbon market could soften farm income cycles by taking land out of crop production and putting it into conservation uses when relative prices favor carbon sequestering over food production.

BMP's increase the agronomic productivity of U.S. cropland, reduce soil erosion, and improve water quality and wildlife habitat. Thus, BMP's help both the global and local environments. The local benefits are consistent with the goals of the much discussed 'green support payments' (Lynch and Smith). However, rather than using taxpayer dollars, this green support payment could evolve in a marketplace with more diligent monitoring and enforcement. Paying farmers to sequester carbon will heighten the stakes for verification that farmers make changes in their farming practices or that they are actually sequestering more carbon.

Lal et. al. estimate the long-term nutrient value of an additional ton of soil organic carbon at $200. A ton of soil organic carbon can be added in 4-5 years. In 4-5 years the value of some of the country's most productive farmland could increase 10 to 15 percent. In summary, a carbon market could increase both income and net worth in the farming community by 10 percent or more.

Leading scientists expect that climate change brought about by increased greenhouse gases may bring more extreme droughts and floods. Thus, American farmers can not only sell a new "crop" in the international environmental service market, but also help solve, at least in a marginal way, long-term weather problems affecting farming.

Implementing a Carbon Emissions Allowance Trading Program

A number of factors must be considered when designing a market for carbon emissions. In contrast to the sulfur market, carbon emission sources are less concentrated. In addition, sulfur could be reduced only by cutting emissions. A carbon market, on the other hand, may work through both outright reductions and sequestration. Considerable care must be taken to assure that incentives do not encourage farmers or others to change the baseline used to reward additional carbon sequestered. For example,

in the short run a farmer or forester could release more carbon via changed practices so that they are ready to gain more when trading begins.

Low-cost systems to measure carbon in the soils are becoming more feasible. As the market develops, new technologies should emerge to make this task economically feasible. Lal et. al have provided estimates of the existing soil organic carbon for the lower 48 states, but improved estimates are needed. The existing base of carbon needs to be mapped. Only additional tons of carbon that are added to the baseline should be eligible for the market.

While many will get bogged down worrying about monitoring how much additional carbon is sequestered on an individual field, there are more effective means for monitoring and verification. Consider the opportunity for farmer cooperatives, grain merchandizers, biotech firms, and almost any agribusiness. Any of these firms could become a wholesaler for carbon sequestering. Estimates of the amount of carbon actually in the soil on an individual parcel may be flawed. However, the error likely has typical statistical properties and conventional statistics apply – estimating many individual parcels and aggregating them into one measurement will improve the estimate considerably. The agribusiness firm would be responsible for monitoring the individual farmers, possibly with some advisory role from USDA on adoption of BMPs. Under this system farmers could be rewarded for adopting BMPs and the agribusiness firm would be rewarded based on estimates of actual carbon sequestered.

Sandor, a student of the history of markets, has been heavily involved in inventing a number of new markets. He postulates a simple seven-stage process for market development:

(1) a structural economic change that creates a demand for new services;
(2) the creation of uniform standards for a commodity or security;
(3) the development of a legal instrument which provides evidence of ownership;
(4) the development of informal spot markets (for immediate delivery) and forward markets (non-standardized agreements for future delivery) in commodities and securities where "receipts" of ownership are traded;
(5) the emergence of securities and commodities exchanges;
(6) the creation of organized futures markets (standardized contracts for future delivery on organized exchanges) and options markets (rights but not guarantees for future delivery) in commodities and securities; and
(7) the proliferation of over-the-counter markets (p.2).

Based on this experience, Sandor develops recommendations for implementing an international pilot program for carbon emissions trading. An international pilot is in keeping with the Kyoto protocol which, during the first phase, puts the burden on developed economies. With trading, those in developed countries would also have the option of involving developing countries by funding low-cost emission reduction projects

and by helping developing countries finance their efforts to prevent destruction of existing forests.

An effective carbon emissions market must have a clearly defined tradable commodity for greenhouse gas emissions - the standard measure to be traded must be agreed. An oversight body is needed, along with emissions baselines and clearly specified allocation and monitoring procedures. Once these standards are in place, existing exchanges and trading systems can be used to facilitate trades. Widely accepted standards will increase the credibility of the trades and help standardize the legal mechanics more quickly. All of these steps will lower the transaction costs in the new market.

With standardization and use of existing exchanges and trading systems, a carbon emissions market is very feasible. If we can trade corn on the Chicago Board of Trade, we can trade carbon. A system of quotes, hedging, and options will evolve. The market for carbon trades is, if fact, already evolving (Sandor). Niagara Mohawk (an electric power company in New York) and Arizona Public Service completed a swap of carbon offsets for sulfur dioxide emission allowances in 1996. Environmental Financial Products purchased rainforest protection carbon offsets from the Republic of Costa Rica in 1997. A subsequent 1.1 million acre program also includes assurance from the Costa Rican government that the area will be placed in a national preserve. In 1998, the Japan-based Sumitomo began converting coal-fired electric power plants in Russia to natural gas to earn carbon offsets.

The road to price discovery is being built. A market for carbon reduction services is now emerging. Carbon markets are being designed in the United Kingdom on the International Petroleum Exchange and in Australia at the Sydney Futures Exchange. Major companies such as United Technologies, British Petroleum and Royal Dutch Shell have also committed to large and early reductions in their own greenhouse gas emissions. Therefore, regardless of whether the U.S. approves the treaty, firms in other countries may soon be willing to pay American farmers to sequester carbon. U.S. action to limit net carbon emissions would help make the benefits and incentives to U.S. agriculture even greater.

Carbon trading is feasible. The prospects of a market will increase this feasibility as new investments are made in technologies and research needed to monitor and standardize carbon measurement. Active trading of carbon could prove an inexpensive insurance policy against the unknown problems that may emerge because of the rapid increase in global carbon emissions. An effective and efficient market-based solution will become even more important as governments around the world tighten restrictions on carbon emissions.

U.S. farmers are well-positioned to help in sequestering more carbon. While helping to clean up the air, the benefits to the sector could be substantial. Farm income and land values should both increase. Local soil, water, and wildlife should benefit. All

the while, carbon trading could also make the sector more resilient to other forces that have persistently created cycles in farm income through a market-based CRP program.

- **For more information**

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This article emerged from two presentations by Dr. Richard Sandor. First, at Monsanto in St. Louis, Mo. and then at the University of Kentucky (UK) as the fall seminar of Gamma Sigma Delta. Dr. Sandor expresses his appreciation to Dr. Bruno Alesii, agronomic systems manager at Monsanto, and Dean Oran Little of the College of Agriculture, University of Kentucky. Both authors are also grateful for reviews of this article provided by Dr. Craig Infanger, Dr. Barry Barnett, Dr. Kim Zeuli, and Dr. Michael Walsh. A version of this article will also be published in United Kingdom, Futures and Options Association Yearbook.

CANADA'S OUTLOOK FOR LIVESTOCK AND POULTRY

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INTRODUCTION

Baseline Process

Agriculture and Agri-Food Canada's (AAFC) medium term policy baseline draws on the work of several other publications. The international baseline is based on the Organization for Economic Co-operation and Development's (OECD) Agricultural Outlook (1998). Other world agricultural outlooks consulted during the preparation of this baseline include the Food and Agricultural Policy Research Institute (*FAPRI 1998 International; Outlook*, and *FAPRI 1998 U.S. Outlook*), and the United States Department of Agriculture's (USDA) *International Agricultural Baseline Projections to 2007* (February 1998).

Canadian macroeconomic projections are taken from the Conference Board of Canada's *Autumn 1997 Forecast*. World macroeconomic assumptions are based on projections embedded in the OECD's *World Agricultural Outlook*, the International Monetary Fund's (IMF) *World Economic Outlook, October 1997*, and the IMF's *Interim Assessment, December 1997.*

The publications mentioned above are crucial inputs in the Canadian baseline process. Because of the size of its economy and agricultural sector, Canada is considered as a "price taker", which means that Canada does not have any impact on world agricultural commodity prices. FAPRI, USDA and the OECD are in the process to finalize their 1999 baseline. Other factor that contributes to delay the 1999 Canadian baseline process is the fact that Statistics Canada will release 1998 cattle and hog inventories on February 25, 1999. For all these reasons, the 1999 Canadian baseline will only be completed in May of this year. What is presented below, is extracted from the 1998 Medium Term Baseline.

The 1998 baseline also incorporates comments received at a Canadian/industry consultation workshop, held in Ottawa on December 15, 1997. Workshop participants included representatives from federal and provincial governments, and industry organizations.

SUMMARY

This document provides a summary for a plausible policy baseline for Canadian livestock and poultry sectors over the next 10 years (1998-2007). It assumes stable world macroeconomic and political conditions, normal weather patterns, and a status quo international and domestic policy environment. Although the baseline is expressed in terms of single numbers, its projections are best interpreted as midpoints of ranges. For this reason, the reader should refer to the major directions, turning points, and trends indicated by the baseline, rather than the specific values.

Macroeconomy Baseline

Key Assumptions

World:

- Growth in developed economies is moderate in this baseline (2-3%)
- For developing economies, growth is stronger (5-6%)
- This baseline incorporates "modest Asian crisis"
- Inflation declines for most regions (developed countries below 3%;single digits for developing countries)
- This baseline assumes realignment among the major currencies. The US dollar strengthens against the ECU and currencies of most developing countries.

Canada:

- This baseline shows modest, but stable growth for the Canadian economy, with annual GDP increases averaging about 3%.
- The prime interest rate remains low, averaging 5.5-6% over the medium term.
- Inflation remains modest, with annual increases in the consumer price index (CPI) below 3%.
- Expected appreciation of the Canadian dollar at the end of the outlook period.

LIVESTOCK AND POULTRY BASELINE

A) Red Meats

Key assumptions

While the elimination of Foot and Mouth Disease (FMD) in Mercosur countries (principally Argentina and Uruguay) has potentially significant implications for world beef markets, it was not taken into account in this baseline.

The FMD outbreak in the Taiwanese herd in 1997 has temporarily removed this major exporter from the market. This baseline assumes that Taiwan gradually re-enters the Asian export market beginning in 2001.

Major Highlights:

- A return to growth in the breeding herd is expected from 1998 to 2003. In the short term, it will keep total exports of meat (including live animals in meat equivalents) below the record high of 1997. Over the medium term, it will generate growth in total exports of 10% above 1997 levels.

- Cattle prices were low as production in North America reached the peak of the cattle cycle, but began to increase in 1997 and are expected to rise up to 2001. Thereafter, prices fall as the next peak of the production cycle is reached.

- Grain transportation reform that took place in 1995 and low grain prices appear to have had a positive impact on cattle breeder competitiveness.For the first time since 1985, net trade of beef (excluding live animals) from Canada was positive in both 1996 and 1997.

Net trade of beef is projected to remain positive over the baseline period.

- Major investments over the baseline period will increased slaughtering capacity in Canada. Meat exports in 2004 are expected to be double the average for 1993-97. Exports of live animal to the US will decline as more cattle will be processed domestically.

- Hog production shows strong growth over the long term, particularly in Western Canada where some of the anticipated growth in capital investment is already beginning to take place.

- Pork prices in 1996 were at the high point of the price cycle. Price strength was further re-enforced in 1997 by supply problems in key exporting countries such as swine fever in the Netherlands, and FMD in Taiwan. Over the long term, pork prices are expected to decline due to continued productivity gains, particularly related to the restructuring of the industry in the U.S. and Canada.

- The baseline shows domestic slaughter continuing to increase in line with increases in domestic packing plant capacity. As a result, live cattle and hog exports to the U.S. decline.

- Currently, Canadian beef exports are mainly to the U.S.. Canada is a net exporter of low quality beef to the U.S. and a net importer of high quality beef from the U.S.. The relationship is reversed on the world market where Canada is a net exporter of high quality beef (largely to Japan) and a net importer of low quality beef (mainly from New Zealand and Australia). Trends in exports indicate increased low quality beef to the U.S. and increased high quality beef exports to the rest of the world.

- Live pig exports to the U.S. have averaged 180 kt per annum since 1996 and are expected to drop significantly as slaughter capacity in Canada increases. Exports of pigmeat will increase as more hogs are processed domestically. The quantity of pigmeat (including live animals in meat equivalent) exported in the U.S. will remain at current levels but exports to non U.S. destinations will increase. Recently, 75% of the exports have been going to the United States, but it is expected that this will drop below 50% by the end of the outlook period.

B) Poultry

Major Highlights:

- International poultry prices decline initially from current high levels, but then increase over the baseline, in line with changes in grain prices. Poultry meat consumption in developed and developing countries continue on a strong growth trend.

- Canadian poultry production increases at an average of 3% per year, based on the expected rate of growth in domestic consumption.

- Poultry prices continue to increase over the baseline, reflecting changes in the cost of production formula.

1998 Baseline Review and Uncertainties

Baseline Review:

- New international baseline (Asian flu, Russia meat imports decline);
- New Canadian macroeconomic baseline with low Canadian dollar;
- Impacts of the pork crisis on Canadian hog producers;
- Significant increase in slaughtering capacity in Canada (Maple Leaf plant in Brandon, Manitoba)
- For the first time, the opportunity now exists for U.S. hogs to be shipped to Canada since the Government of Canada implemented (December 1998) new regulations which permit the importation for immediate slaughter of U.S. hogs from states which have achieved freedom of pseudorabies.

Uncertainties:

- Agricultural policy: Agenda 2000, WTO negotiations

- The impacts of changes in world markets on domestic agricultural production represents another area of uncertainty as world agricultural markets continue to liberalize.

- Biotechnology: Genetically Modified Organisms (GMOs)

- Weather: El Nino, La Nina

SOUTH AMERICAN INFRASTRUCTURE IMPROVEMENTS

Gregory L. Guenther
Director, National Corn Growers Association

U.S. agriculture is currently at a crossroads. In agriculture, we depend on foreign trade for our prosperity. We have enjoyed an immense advantage over our competitors for many years. Today, we are on the verge of losing that edge and plunging our agricultural sector into an economic crisis that makes the effects of the Carter embargo of the eighties look like a minor correction in the futures market. The competitive advantage I am talking about is our transportation infrastructure. As we in the U.S. argue about the relative merits of rail Vs. barge, and the potential economic gains Vs. the environmental costs, the governments of South America are busily eroding our competitive advantage, and not slowly either.

The areas that I want to discuss with you today are Production Practices, River, Rail and Road improvements, primarily in Argentina, but the same changes are taking place throughout most of the South American Continent.

Production Practices:

The South Americans have the ability to dramatically increase production virtually any time they want to. Increasing acceptance of commercial fertilizers primarily Phosphate and Nitrogen combined with new varieties of corn bred especially for Argentine growing conditions will soon increase national average yields from the 90 Bu/a. they now produce to close to the 130 Bu/a we enjoy here. As yields improve and the income stream increases, less land will be seeded to alfalfa or pasture, and put into grain production. The construction of what will be the worlds largest nitrogen manufacturing plant soon to be completed in Bahia Blanca south of Buenos Aries on the coast will provide Argentine farmers with a inexpensive supply of a domestic fertilizer critical to corn production.

Increased availability of storage, both on-farm and commercial, will give the Argentine grain industry much needed flexibility on when and how they market their crops. This will primarily impact corn and wheat exports as soybeans are crushed or processed locally at the ports and shipped out of the country primarily at harvest. The Argentine government offers significant credits for the export of processed soybeans. Their goal is to keep the economic development inside their own borders. There are no incentives for corn. Corn is exported as a whole grain with little or no processing. Currently virtually none of the domestic corn production goes into cattle feeding. This may change, but right now all domestic beef is grass fed.

As the Argentine economy recovers the larger farms formed by small farm failure will have easier access to capital. (In December 1997 when I was there farmers were able to borrow Pesos for the first time in years.) These larger farms will use that capital to increase inputs such as fertilizer, better seed genetics, more herbicides and larger more efficient equipment to further increase production. Expanding market access through Mercosur will reward them handsomely for the risks and the investment.

Road and Truck Improvements:

The main road system in Argentina is little different from what we enjoy in our country. The fact that many of the side roads are dirt and unpaved is not significant. Most of the grain is transported at harvest and the weather window for harvest is much wider there than it is here. The roads are passable when they need to be and an inconvenience, no more during the off seasons. The majority of the corn is grown within 300 km. (200 miles) of the ports. Trucks are the main method of hauling grain that distance. Other people who have been in Argentina have laughed at the trucks that haul the grain from the fields and farms to the export terminals. I was not amused. Their system works quite well for them and everything is designed around the trucks which have no hydraulic dumping system. The trucks and trailers are relatively simple and inexpensive. And most importantly, they work. Numerous trucking firms exist and requests from a farmer who is in harvest for 150 to 200 trucks is not uncommon and easily filled. The truckers live in their trucks and a wait of one to three days at the terminal to unload is not remarkable.

Rail Improvements:

The Argentine government has undertaken a major project to privatize the railroads in the country. While maintaining ownership of the tracks and land, fifty-year leases are being let on a competitive basis. One of the conditions of the lease is that the track is in better condition at the end of the lease than at the beginning. Most operators are not finding this hard to do. The railroads are building alliances with U.S. companies to improve their ability to offer service. This sector of transportation is still somewhat slow but gaining momentum rapidly. The difference in track gauges is being overcome with a number of ingenious methods. They have developed a method of lifting the cargo boxes off of the trucks (railroad wheels) and placing them on trucks of another gauge with a crane, another method is to use pits and conveyer belts to rapidly off-load one train onto another. The largest Argentine railroad recently merged with a Brazilian railroad company.

Ports and Deep Draft Channel Improvements:

Argentina has undertaken a $650 million dredging project to allow Panamax (50 K metric ton) vessels access to interior ports at Santa Fe and Rosario. The export terminals at Buenos Aries that once served the ocean vessels are gone. Up-river competition has ended their usefulness. Additional dredging will allow even Cape sized vessels (110K to 120K metric ton) access to these ports as well. The grain export terminals have been privatized and investment for improvements and upgrades are pouring into this sector of their economy. These ports are operated in a highly efficient manner at a good profit margin. Additional soybean crush capacity is being added. There is a competition going to determine who will process and ultimately export the additional soybean acres being grown in Brazil. The Brazilian government would like to move those beans east to their coast and process them in Brazilian plants. The Argentines' are making every effort to entice them south. In addition to the growing acres in Central Brazil, the soybean regions of Bolivia and Paraguay are now connected to Argentine processors by barge.

River and Barge Improvements:

The governments of Argentina, Brazil, Paraguay and Bolivia have formed a partnership to improve navigation on the Parana and Paraguay rivers. $60 million dollars have been invested in these river systems to enhance navigation. Currently a towboat can travel 1800 miles without lock delays. There are no locks. A U.S. based company, American Commercial Barge Lines is the largest barge line operating in South America. Many of the new barges manufactured in the U.S. over the last 5 to 7 years have gone to South America. ACBL has initiated round-the-clock navigation on the river system. Operating 15 barge tows for most, if not all of the river system. Shipments that used to take 10 to 12 days now take 4 to 5 days. Soybeans from the above mentioned countries all flow by barge to Argentine crushers in a very cost competitive manner.

U.S. Shortcomings:

Where does that leave us? The majority of the locks and dams on the Mississippi and Illinois River system surpassed their useful life 20 years ago. Improvements in towboat capacity and improvements in other areas of the navigable river system have rendered them obsolete. They are too short, too slow and over utilized. Delays on the river system cost producers over $20 million dollars a year in higher shipping costs and the number continues to climb.

Rail consolidation and increases in movements of competing commodities will quickly drive grain-shipping rates skyward. We have already experienced this with the UP SP merger that left us with only two viable railroads west of the Mississippi River.

The U.S. is in very real danger of becoming a residual supplier of food and fiber to the world. The past year has taught us that the export market is vital to the health of agriculture and rural America. As our competitive edge erodes, other countries like Argentina will quickly step in and fill the voids with cheaper commodities due to their more efficient transportation systems.

What can we do???

There are seven locks that need to be upgraded five years ago. They are Lock and Dam 25, 24, 22, 21 and 20 on the Mississippi River and La Grange and Peoria locks on the Illinois River. These locks need to be upgraded to 1200 foot chambers to allow a barge tow to pass through intact without making two passes as they are currently forced to do. We need to ensure that the COE maintains the mandated channel depths that allow the most efficient loading of all barge traffic. This includes proper management of the Missouri River and the waters that feed it as well. We also need to support the COE budget for current and deferred maintenance. We need funding, authorization and a commitment to build these structures in a timely and cost efficient manner that is not possible under current budget processes. And we need to pursue this agenda aggressively and constantly until we achieve these goals.

EVOLUTION OF AGRICULTURAL PRODUCTION IN LATIN AMERICA

Dr. Michael Cordonnier
President, Soybean & Corn Advisor, Inc.

Over the last two decades, Brazil and Argentina have emerged as major agricultural competitors of the United States particularly in the production of soybeans and corn. Commercial soybean production was first introduced in Brazil in the early 1960's and Brazil has now developed into the world's second largest soybean producer. Argentine agriculture has evolved from a pastoral beginning to one now emphasizing row crop production. Argentina is now the second largest exporter of corn in the world and a major producer of soybeans. In my brief comments today, I will highlight the major factors contributing to the rapid development of the agricultural sector in these countries, some of the key developmental trends in recent years and what lies ahead for agriculture in Brazil and Argentina.

How did Brazil and Argentina emerge as leading world agricultural producers in such a short period of time? The answer to this question is that both countries took advantage of their natural strengths. Brazil's most obvious advantage is the tremendous land mass encompassed in this the fifth largest country in the world. Brazil is 9% larger than the continental United States and most of the country enjoys a wet tropical climate. The major area of agricultural expansion thus far has been in the *Cerrados* Region of central Brazil. These savanna-like lands are characterized by short twisted trees interspersed by sparse grass. The price of this *Cerrado* land is relatively cheap and they are easily cleared and converted to mechanized agricultural production. In their native state the *Cerrado* soils are quite infertile, but regular application of lime and fertilizer can make them relatively productive.

Brazilian farmers have also been very quick to embrace new technology and adapt it to their own situation. Leading this new technology has been the development of superior varieties suitable for tropical environments. Brazilian scientist have done a superb job of developing germplasm that excels in the hot tropical climate of central Brazil. Brazilian farmers have also been quick to adopt improved tillage practices such as no-till and pest management practices utilizing the newest herbicides and insecticides. And lastly, with the end of hyper inflation, Brazilian farmers now have expanded marketing options encompassing a new futures exchange in Sao Paulo.

Argentina's major agricultural strength stems from its fertile Pampas soils. This broad expanse of flat and fertile grassland is easily converted into excellent agricultural production. As a testament to the soil's native fertility, Argentine farmers have developed over the years a long term rotation strategy that maintained the native fertility of the soil to such an extent that commercial fertilizers were rarely used. Recently, Argentine agriculture has moved to more of a corn and soybean rotation

similar to that of the United States and now the native fertility must be supplemented by commercial fertilizers.

Argentina has several other more subtle advantages. First, any advances in agricultural technology developed in the United States is generally directly transferable to Argentina since the soils, climate and latitude of Argentina are very similar to those of the United States. Secondly, Argentine producers also have an advantage in that the major agricultural production regions of the country are in close proximity to domestic markets and export facilities thus greatly reducing transportation costs. These advantages allow Argentina to be the low cost producer in South America.

In recent years there has been several major trends that have been key in propelling South America to the forefront of world agricultural development.

1. **New lands being brought into agricultural production.** This trend has been particularly evident in Brazil where the major expansion has been occurring in the central regions of Brazil primarily in the states of Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais, Tocantins, Bahia, and Maranhao, Piaui, and Rondonia. The majority of the new production has been carved out of the *Cerrado* land which is cheap and quite easily converted to agricultural production. This trend has been accelerating in recent years and shows no signs of slowing down.

   Agricultural development has been the primary driving force behind this rapid northward expansion in Brazil. The vast majority of this land is converted to either pastures or row crops with soybeans being the major crop planted in these areas. Other forces driving this expansion are logging and mining, but they play only minor roles compared to agriculture. There still remains in Brazil hundreds of millions of acres of land that could potentially be converted to agricultural production. The speed at which this land could be converted to agricultural production will depend on a complex set of factors including governmental land use policy, fiscal policy, world commodity prices as well as social, cultural and environmental concerns.

   This conversion of new lands into agricultural production is not limited to Brazil. In southern Paraguay and eastern Bolivia a similar trend has emerged in recent years. In fact, much of this conversion has been driven by Brazilian farmers who move into these areas searching for new land to produce soybeans. This trend has been exhibited to a lesser extent in Argentina where the expansion of agricultural production outside of its core area of the Humid Pampas has been limited by unfavorable climatic conditions.

2. **Rapid adoption of new technology.** Brazilian and Argentine farmers have become very proficient at adopting new technologies as soon as they have become available. This trend is most obvious in availability of new varieties, tillage practices, pest management and machinery. Whatever is available to the U.S. farmers is generally available to the producers in South America. Much of this technology transfer has been aided by the fact that the same agribusiness companies that develop and market these technologies in North America market

the same products in South America. This has allowed the South American farmers to make very rapid progress in improving crop yields. Today, soybean yields in Brazil and Argentina are approaching the levels of the United States.

3. Emphasis on infrastructure improvements. The biggest impediment to rapid agricultural expansion in Brazil has been a lack of adequate infrastructure- roads, rail lines, water transport and port facilities. The topography of Brazil has made this infrastructure development quite difficult. Mountains along the coast of Brazil forces the major rivers to run west toward the interior of the continent. This has hampered the development of any type of water transportation system to coastal port facilities. It has also made the building of highways and rail lines more difficult.

To address this problem, the Brazilian government has turned to the private sector. Major highways in Brazil are being converted into toll roads operated by private companies in the hope that they will be better able to build and maintain the roads than the cash-starved local and federal governments. The government has also given incentives to the private sector to develop rail lines and water transportation systems into the interior of the country. New port facilities have been built on the Amazon River and a rail line is being extended into the heart of the expanding agricultural area. Established port facilities are now being privatized in order to improve their operations and make them more competitive. All these are efforts to overcome the biggest problem facing Brazilian agriculture - transportation.

Argentina has also recognized the advantages offered by efficient transportation and has taken steps to strengthen that sector. Major highways were converted into toll roads several years ago and the result has been a dramatic improvement in the condition of these roads. Dredging of the Parana River and improvement and expansion of port facilities at the city of Rosario has made this city the center of Argentina's agricultural export activity. This infrastructure improvement in Argentina has been much easier than in Brazil because of the concentrated nature of Argentine agriculture. In Brazil, the agricultural expansion is occurring 1,500-2,000 kilometers away from the primary domestic markets and export facilities. In contrast, 75% of Argentina's agricultural production lies within a 300-400 kilometer radius of the city of Rosario. The topography of the area is also very flat which has facilitated this development of this infrastructure.

4. Global markets. In recent years, it has become much more evident that the South American farmers have become integral partners in the global agricultural economy. Today, it is not uncommon to see a rapid pace of export of soybeans and soy products out of Brazil immediately after harvest and then to later have imports of soybeans into Brazil to supply its domestic needs. This globalization is also evident in the United States when poultry producers in the Southeastern U.S. find it advantageous to import cheaper Brazilian soybeans than more expensive soybeans from the Midwest.

This free flow of agricultural commodities has been aided by the fact that many companies involved in this commerce have operations in both North and South America. With continued consolidation in the agricultural sector, this integration of global markets is

certain to accelerate in the future.

The question before us today is to try to determine what lies ahead for these two major competitors of the United States. What trends do we see emerging as the driving force behind the continued agricultural development in Brazil and Argentina?

1. Continued agricultural expansion. In the last several decades, Brazilian agriculture has emerged as one of the major driving forces in this the eighth largest economy in the world. With it huge land mass, favorable climate and energetic agricultural sector, there is no indication that agricultural expansion shows any signs of slowing down. Commodity price fluctuations could speed up or slow down this process, but it is certain that the expansion will continue. It is a natural progression of events to push the agricultural frontiers further and further into the new lands of Amazonia and beyond.

This agricultural expansion will continue to impact the agricultural sector here in the United States especially the U.S. soybean producers. Soybeans have been the primary driving force behind much of this expansion in Brazil and they will continue to do so in the future. Soybeans offer many advantages over other crops in Brazil. They are well adapted to the soils and climate of the region, productivity is comparable to the U.S., the price of the crop is based on world markets and the crop offers excellent liquidly. And lastly, Brazilian farmers like to grow soybeans. They are very good at producing soybeans and soybean expansion in Brazil shows no signs of abatement. No comparable argument can be made for any other crop in Brazil.

In Brazil, soybeans are produced primarily as a monocrop. Less than one third of Brazil's soybean crop is rotated to other crops in any given year and in the new expansion areas the percentage is even less. Therefore as agricultural expansion continues in Brazil, soybeans will be the major beneficiary of this expansion. This continued expansion of soybean production in South America could have a significant negative impact on the ability of U.S. producers to maintain their share of the world's soybean market.

Agricultural expansion in Argentina is less straight forward. Expansion of row crops in Argentina in recent years has come at the expense of cattle production. Bringing new lands into production in Argentina is not a common occurrence. It is more a function of a reshuffling of existing area into different crops. The shift away from beef production into row crops such as soybeans, corn, sunflowers and cotton appears to be accelerating and is expected to continue unabated. As in Brazil, price fluctuations can temporarily affect the speed of this transition, but not detour it.

2. Infrastructure improvements and privatization. As agriculture has expanded into central and northern Brazil the lack of adequate infracture has become painfully obvious. To correct these shortcomings the government has embarked on an ambitious program of cooperation with the private sector to address these issues. This has included turning over the operation of major highways to private companies, aiding in the purchase and development of land for new rail lines, sharing part of the cost of new water transportation

systems and privatizing utilities and port facilities. All this is being done to lower the cost of production and improve the efficiency by which agricultural commodities are transported throughout the country.

The Brazilian government has reluctantly realized that its role in this process should be one of coordination and oversight and not of actual implementation. The private sector has demonstrated that it is capable developing and managing these assets much better the federal government. This is a major shift in governmental policy in Brazil which is certain to have a lasting impact on the success of how this critical issue is addressed in the future.

3. Biotechnology specifically designed for the South American market. Until now, the agricultural sector in South America has been the beneficiary of biotechnology research geared toward the North American market. To their credit, the farmers in South America have been quick to embrace this new technology and adapt it to their own particular situation. This has encouraged companies conducting this type of research to consider developing products specifically designed for the South American market.

Major biotech companies have announced planes to build research facilities in Brazil to work on not only the major row crops of the region such as soybeans , corn, rice and cotton, but also important South American crops such as citrus, coffee, coco and sugar. This focused emphasis on South America will likely result in improved agricultural production in the region.

As we have seen, Brazil and Argentina have made remarkable progress in recent years in expanding and improving their important agricultural sector. Many of the same forces that have aided in this development in the past will continue to play critical roles in the future. It is important for American farmers to realize that this agricultural expansion in the Southern Hemisphere is not a temporary phenomena. Rather, it is based on solid economic reality and it is certain that it continue into the future.

Figure 1.   Area of Brazil Compared To The United States

Figure 2. States of Brazil

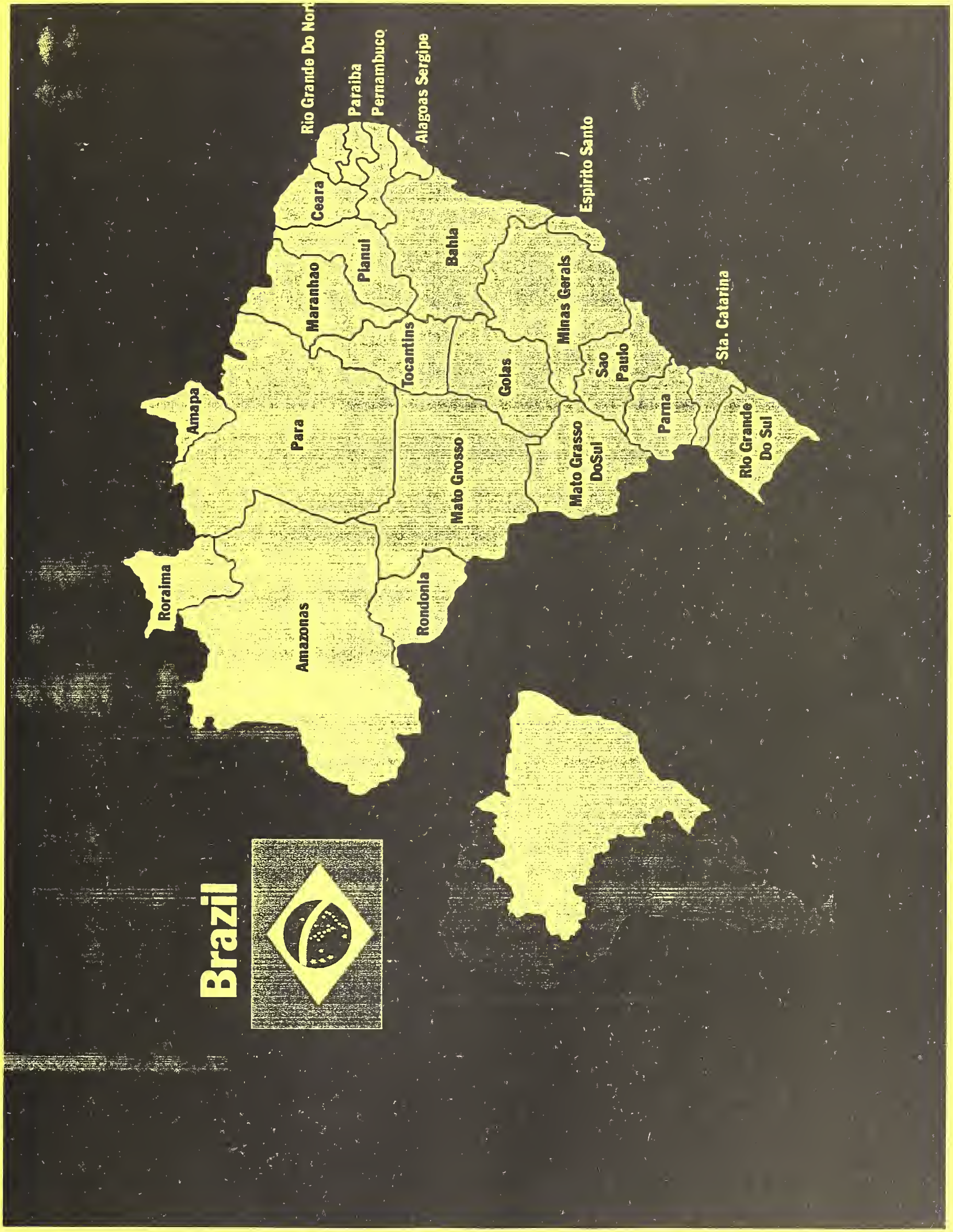


Figure 3. Mato Grosso - Main Expansion Area Of Brazil

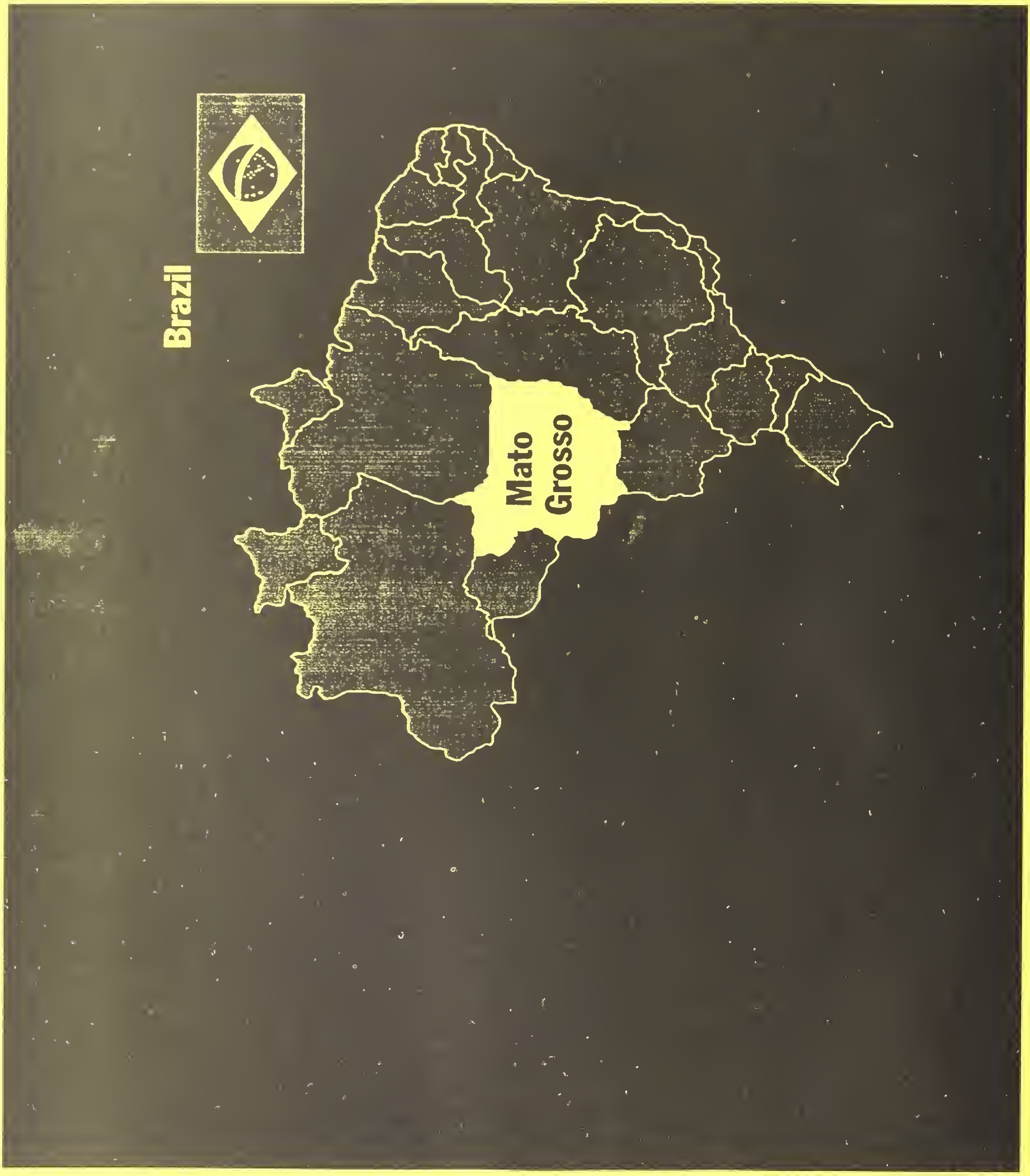


Figure 4. Area of Mato Grosso Compared To The Midwest

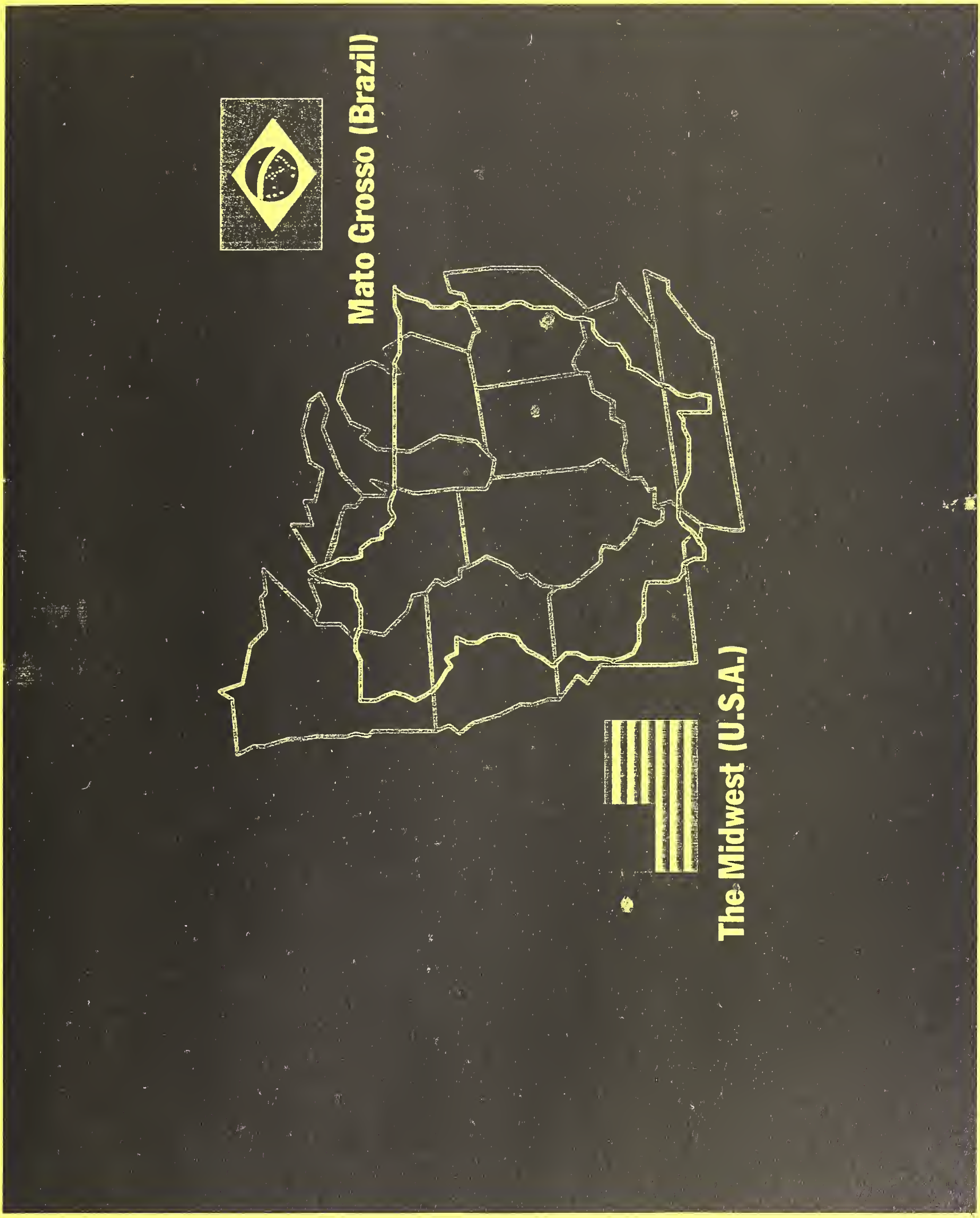


Figure 5. Brazilian Soybean Yield - 1980 To 1998

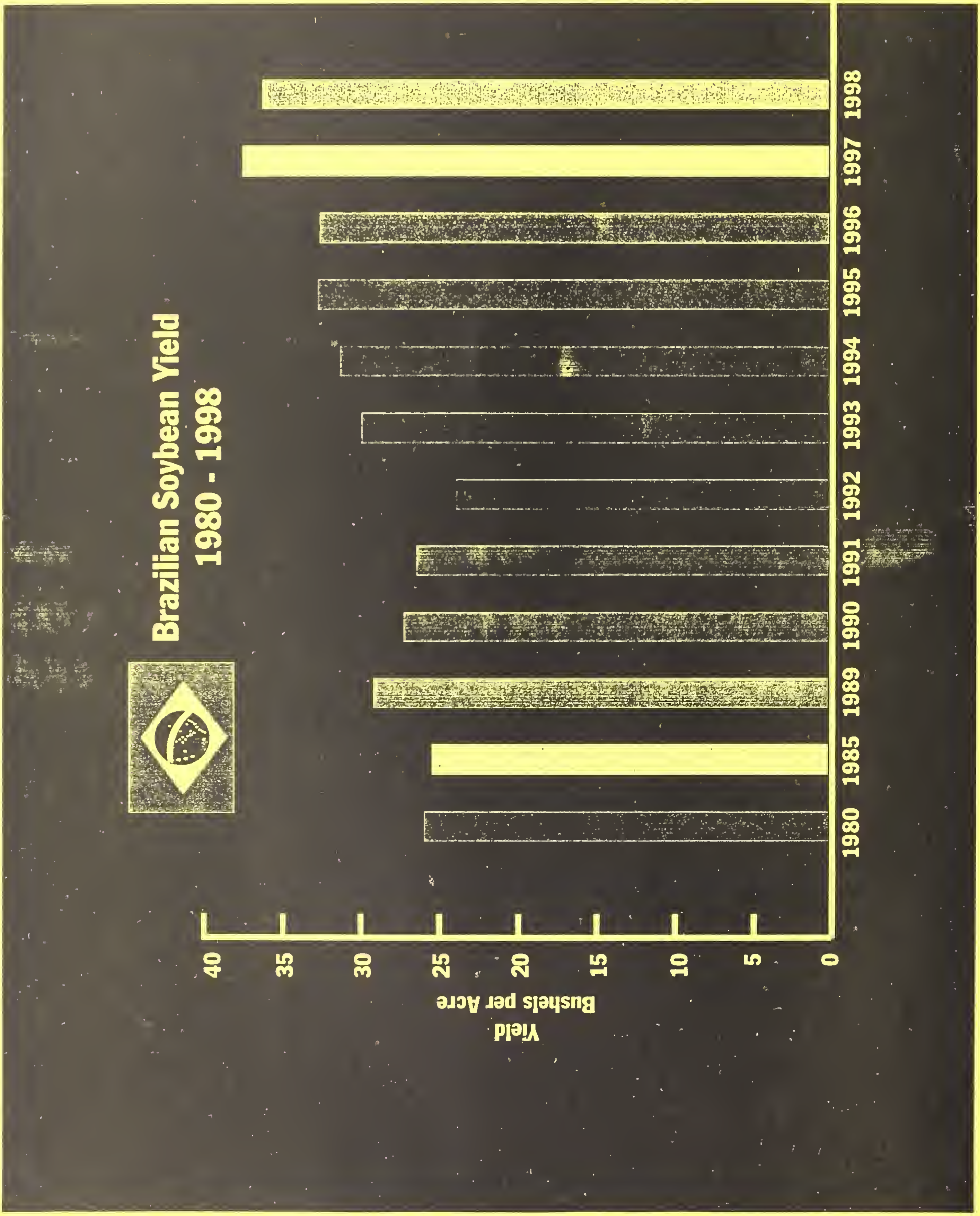


Figure 6. Provinces Of Argentina

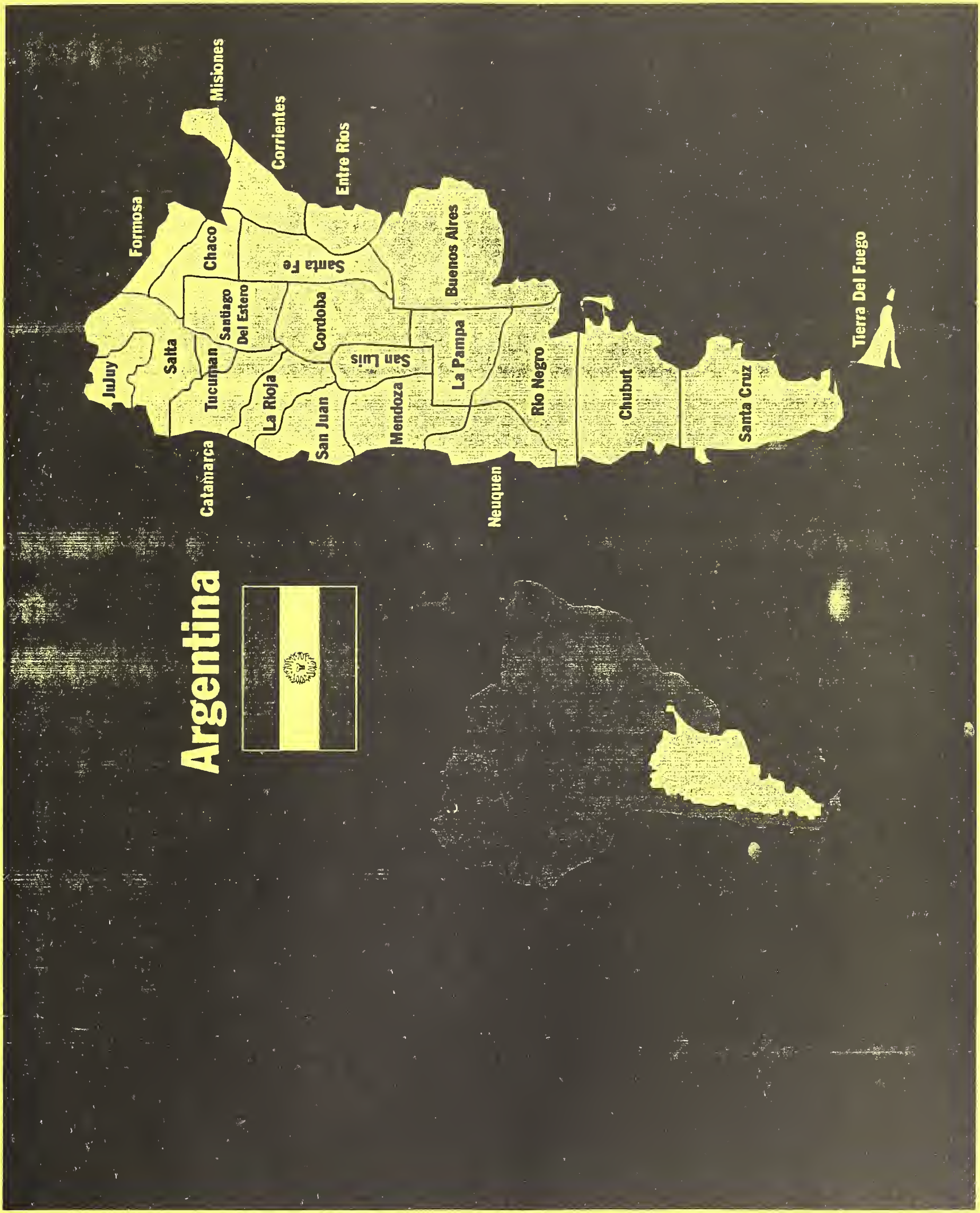
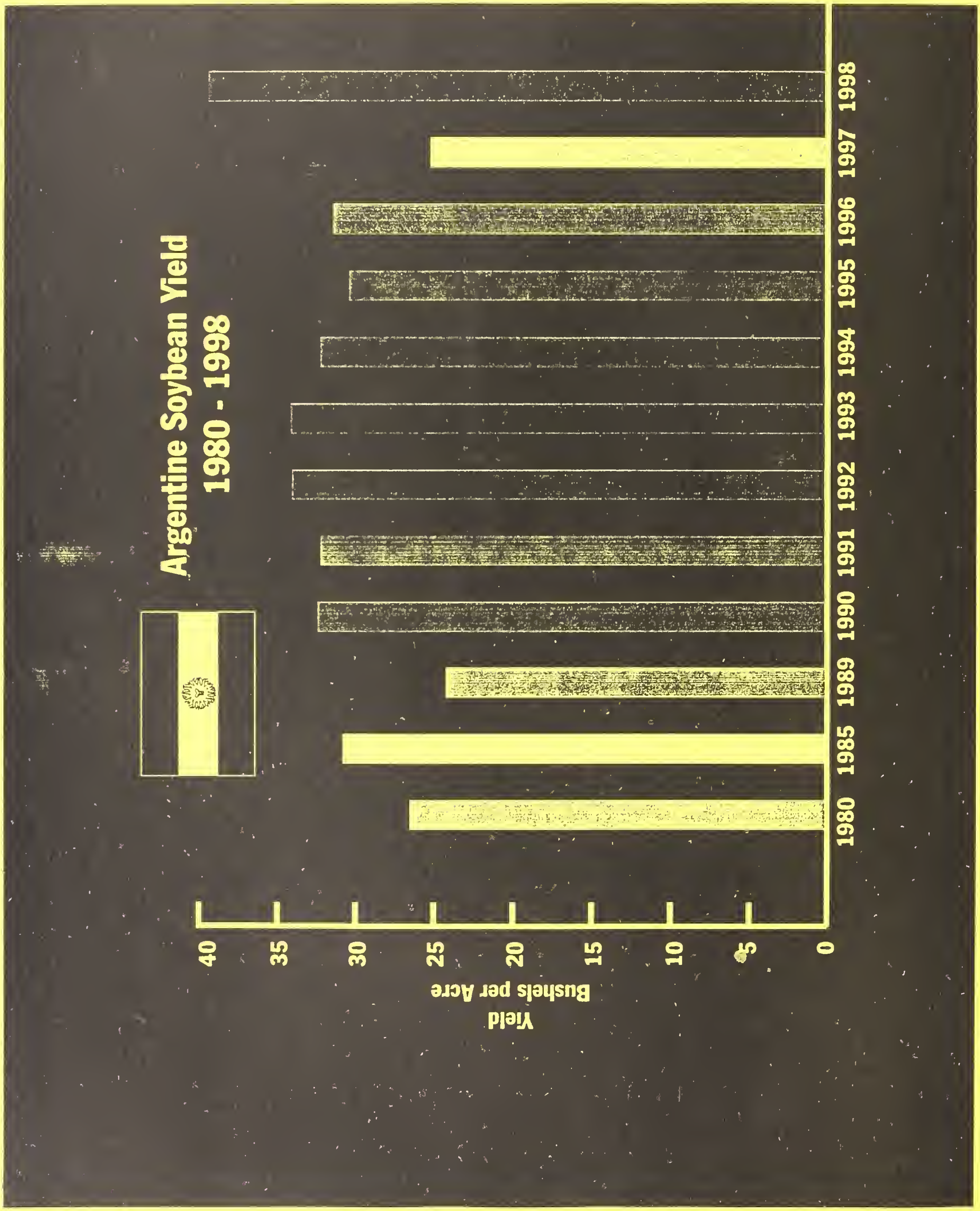


Figure 7. Argentine Soybean Yield - 1980 To 1998



AG OUTLOOK 1999

Thomas K. Schwartz
Executive Vice President, Beet Sugar Development Foundation

Good morning ladies and gentlemen. First of all, I would like to thank John Love for asking me to be here with you today. I hope that my presentation will give you some insight into the advancing technologies in sugar crop production. Although I will be speaking on both sugar beet and sugar cane, I must preface my remarks by telling you that I an no expert in sugar cane production. Even though, sugar beet and sugar cane are very different crops, as you will see, through my presentation, the advancing technologies are similar, as are they in most agronomic crops.

To begin with a bit of background. In 1998, Sugar Beets were grown in 14 states, on 1, 430,000 acres and will produce about 4.4 million tons of sugar. Sugar Cane was grown in 4 states plus Puerto Rico on 877,000 acres for an estimated production of 3.3 million tons. Sugar Cane was introduced to the Americas by Columbus, and Sugar Beet production came much later, around 1836.

When we look at the technology of sugar beet and sugar cane production, it can most easily be broken down by what I will refer to as Agronomic Factors, I have them listed here. Biology and Physiology, in essence the basics. Genetics and Breeding, as it relates to and interacts with crop growth. Soil Management and Crop Establishment, the interaction of the crop with the environment. Nutrition, primarily the fertilization of the crop. Diseases, Insects, in which I include Nematodes and Weeds, as these are the major pests of the crop, and finally, Harvest and Quality factors, which ultimately effect the processability of both cane and beet. I would like to discuss each of these separately, however, you will see that they all interact.

Biology and Physiology

The biology and physiology of the crop is the basis for all the other sciences names. It is what forms the relationships between the various components of crop growth and production. This is long term/high risk research, but is essential knowledge to be able to proceed in advancing the more applied technologies. There have been rapid advancements in instrumentation and availability of tools used in physiological research. An example is automated measurements of physiological properties in the field, such as photosynthesis or leaf area index. Chemical instrumentation has advanced also, especially in the areas of Chromatography and Spectroscopy, making it possible to determine many physiological characteristics more rapidly and precisely.

Genetics and Breeding

Traditional breeding programs in both sugar beet and sugar cane have been very successful. Major milestones that can be cited include the discovery of monogerm seed in sugar beet, major advancements in disease resistance in both sugar beet and sugar cane, and a steady

increase in yield and sucrose content. However, it is felt, given the limited gene pool within these species, that we may be near the upper limits of what can be obtained with only traditional breeding programs. Genetic engineering, through biotechnology, is our next major stepping stone. The technology in this area is, as you know, advancing more rapidly than can be reported on. There are three major areas in this program. Isolation of the needed gene, insertion of that gene, and regeneration of the plant material. As I speak later of the various pest problems and yield and quality parameters, the isolation of the needed genes will be addressed. The techniques for the insertion of a desired gene include such things as bombardment guns, which use DNA-coated gold particles and the use of biological vectors, such as Agrobacterium. Sugar beet is more difficult to transform and to regenerate than many other crops. However, advances are being made in tissue culture techniques that are speeding up this part of the process. This whole process is not as simplistic as I have outlined. Even after the desired gene is located, inserted, and the material regenerated, the genetic engineer and the traditional breeder must work together to incorporate this into existing breeding lines, while maintaining the original traits and the new trait or traits which came from the genetic engineering process. In line with this, significant efforts are being made in gene mapping to identify important genes. Areas of most promise in the near future are herbicide resistance, disease resistance, and yield and sucrose content.

Soil Management and Crop Establishment

As with most agricultural crops, the traditional practices of deep plowing and heavy disking are going away. We are also moving away from flat planting in sugar beets, a practice which lent itself to severe erosion by both water and wind. New equipment is being developed for incorporation of minimum or reduced tillage operations. Along with this, planters are being developed, which do an excellent job of planting into this type of field preparation, while still allowing for good germination and crop establishment. The practice of planting on formed beds has also aided in reducing the erosion problems.

Nutrition

Crop fertilization is very important in sugar beet production. As in most crops, the primary fertilizer applied is some form of nitrogen. For many years, fertilization was done on a broadcast basis, utilizing recommended rates for the crop and the yield expected. Often this led to over-fertilization. Not only is over-fertilization costly, but it can create environmental problems. The use of soil analysis and petiole analysis have taken us a long way toward the more accurate and discriminate use of chemical fertilizers. Now we are entering a new era, using satellite imaging and global positioning to determine the needed fertilizer, and to apply that fertilizer more accurately.

Diseases

Diseases account for the greatest losses in both sugar beets and sugar cane. The traditional methods of disease control, namely varietal resistance, crop rotation, cultural practices, and fungicides, have been utilized for a number of years. However, due to agronomic and economic restriction, and resistance to some fungicides, in recent years, the diseases seem to have been winning the war. As an example, the states of North Dakota and Minnesota alone estimate they lost 70 million dollars in 1998 to one disease, caused by the fungus Cercospora. We are confident that the future advances in the area of disease control will lie in Genetic Engineering, as I mentioned earlier in my talk.

Insects

There are several major insect pest of sugarbeets. These can cause damage either directly or indirectly, by transmitting diseases. The traditional means for control of insects are similar to those mentioned for control of diseases: chemical insecticides, cultural practices and crop rotation. These have worked well in the past, but again similar to the disease situation, there are environmental concerns and an increase in resistance. Biological control of insects has been a growing science for years, however, it has not been effective in controlling sugar beet insects. Recent developments in technology have taken us one step further than that. Examples include the use of trap crops for the control of the sugar beet cyst nematode. This technology incorporates the use of either a special type of radish or mustard crop, preceding the sugar beet crop, which in essence disrupts the life cycle of the nematode, causing a dramatic reduction in population. This practice does not work in all places where nematodes are a problem, but it is effective in many areas. Another good example is the recent discovery of a fungal pathogen, that is very effective in attacking and controlling the sugar beet root maggot. The areas of biological control, natural predators and ultimately genetic engineering will be the future of developments in insect control.

Weeds

For many years, the only means of weed control were hand labor and cultivation. Then came the era of herbicides, both pre- and post-emergence, where we were able to virtually eliminate hand labor. This has been effective, but again has been expensive and has raised environmental questions. The two up and coming areas of advancement in weed control still utilize herbicides, however in very different ways. The first lies in the development of equipment to apply very low volumes and low rates of herbicides, referred to as micro rates. This is certainly a more environmentally friendly means of herbicide application and has been shown to be very effective. The second is the one which I am sure most of you are familiar with. This is the use of genetic herbicide resistance or tolerance. This advancement through bioengineering and transgenics is now a reality. In sugar beet, we have varieties ready to go to the commercial fields which are resistant to two of the broad spectrum herbicides, Roundup and Liberty. We are currently awaiting EPA approval for the use of these herbicides on sugarbeets. Due to this fact, I would expect to see the first commercial production of transgenic herbicide resistant sugar beet in the 2000 growing season. Development of herbicide resistant sugar cane is also very near and should be commercial in the next few years.

Harvests and Quality

Definitely the goal in harvesting is to deliver the best possible raw material to the sugar beet factory or sugar cane mill. This not only means a high yielding crop, which is also high in sucrose content, but one which is low in impurities and in good physical condition. Through traditional breeding programs and fertilizer management, we have continued to make advances in yield, both tonnage and sucrose content, and a reduction in impurities, especially nitrogen containing compounds, which can cause difficulties in processing. The industry continues to develop new harvest equipment which is gentler on the crop, therefore allowing us to deliver a better quality raw material to the factories and mills. However, again, as I mentioned when I was speaking on Genetics and Breeding, we feel that we may be reaching a plateau with our existing gene pool and traditional method. Again, steps in biotechnology will be combined with the basic science of physiology. If through genetic engineering we are able to express the desired genes, it may be possible to go beyond our current yield plateaus in tonnage and sucrose content, and possibly to alter the levels of non-sucrose components in the sugar crop. Even further than that,

we may be able to change the form of sugar that the plant produces and stores. Two examples of this include the recent discovery and description of a super active form of the sucrose transporter and the discovery of a non sugar beet gene, which when inserted into a sugar beet causes the sugar beet to store fructans, rather than sucrose.

Now that I have outlined where our traditional technology is going, the question is where are these advances coming from. The answer is many places. The research and advancements I have mentioned are coming both from the Public and the Private sectors. In the Public Sector, both the United States Department of Agriculture/Agricultural Research Service and the State Land Grant Colleges are very active. In both sugar beet and sugar cane, the USDA/ARS is involved in the more basic research and the Land Grant Colleges are working to develop the more applied research. In the Private Sector, the research and developments are spread across Research Institutes, Seed Companies, Agro-chemical Companies and yes, the Sugar Companies themselves.

The structure of the sugar industry in changing rapidly. Not too may years ago, in the US, our sugar companies were totally domestic, and either cane or beet. Now we have more companies which are involved in both beet and cane sugar operations, some of these companies being multinational. The seed industry has moved from smaller domestic companies, to larger international companies, as has the agro-chemical companies. This movement has certainly had a positive effect on the development of new technologies in the area of sugar crops.

Another area which has stimulated the advancements in technology of sugar crop production is the global interaction of the people involved. On a national basis, we have such organizations as the American Society of Sugar Beet Technologists (ASSBT) and the American Society of Sugar Cane Technologists (ASSCT). Both of these groups promote the interaction of technologists and the exchange of information in their respective fields. Internationally, we have the International Society of Sugar Cane Technologists (ISSCT) and the International Institute for Beet Research (IIRB). Here also, the interaction and exchange of information has aided in the development of new technologies.

In conclusion, over the long history of sugar crop production in the US, we have come along way in the area of production technology. However, we feel that we still have along way to go. Especially with the increased development of biotechnology, advancements in the near and long term are plentiful. The sugar industry, through its partnerships with public and private institutions, will continue to strive to develop the needed technologies to advance our industry in the years ahead.

Agricultural Outlook Forum For Release: Tuesday, February 23, 1999

THE OUTLOOK FOR FOOD PRICES IN 1999

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After increasing 2.2 percent in 1998, the Consumer Price Index (CPI) for all food is expected to increase 2 to 3 percent in 1999. Food at home is projected to increase 2 to 2.5 percent while food away from home should increase 2.5 to 3 percent. The 1998 increase of 2.2 percent was the smallest increase for all food CPI since 1993 and follows the baseline projection of an average growth rate of 2.3 percent from 1998 to 2008 . Although 1999 looks like another good year for consumers, there are three factors that may determine if the increase for all food is closer to 2 or 3 percent.

The first unknown is whether the sluggish export market for beef and higher-valued cuts of pork and poultry continues throughout 1999; the second factor is if the expected 2 percent increase in milk production can meet consumer demands for butterfat products in 1999, including gourmet ice cream, cheese, and butter; and the third uncertainty is whether higher expected retail prices for oranges and bananas continue longer than the first six months of 1999. The late December 1998 freeze that hit the citrus areas of central California is expected to raise retail prices for fresh oranges 40 to 50 percent for the first 6 months of 1999. Also, higher retail prices for bananas are expected throughout 1999 and peaking in April, due to tropical storm Mitch which hit the banana growing areas of Honduras and Guatemala especially hard in November 1998. Combined, these food categories account for 39 percent of the food at home index: beef, pork and poultry account for 19 percent, dairy and related products account for 11 percent, fats and oils (including butter) account for 3 percent, while fresh fruits account for an additional 6 percent.

Retail food price changes are underpinned by general economic factors that influence food prices and the relationship between farm and marketing costs. In recent years, food price increases have been small due to the low general inflation rate, which is forecast to increase 2 to 3 percent in 1999 after increasing 1.9 percent in 1998; a larger share of the food dollar going to purchases of food away from home, which has averaged 45 percent the past two years; the continued decline in the farm value share of the retail price for most food items, which is expected to average 23 to 24 cents in 1998 and 1999; and increasing economies of size in the farm sector.

Food price changes are also a key variable determining what proportion of income consumers spend for food and what is left for purchases of other goods and services. In 1997, 10.7 percent of household disposable personal income went to pay for food, with 6.6 percent for food at home and 4.1 percent for food away from home. The downward trend in the proportion of household disposable personal income used for food should continue into 1998 and 1999. Preliminary figures on food sales for 1998 show food at home spending up 1.9 percent and away from home spending up 1.0 percent. After adjusting 1998 food sales for inflation, which provides an indicator of food quantities actually purchased, food at home spending went down 0.1 percent

while food away from home spending went down 1.5 percent. With continued competition between grocery stores, restaurants and fast-food establishments, this pattern is expected through 1999.

The food at home CPI increase of 2.2 percent in 1998 was moderated by lower grain prices and adequate feed supplies, large supplies of competing meats, adequate supplies of coffee, increased sugar production, and strong competition in the soft drink and prepared food industries. The 1998 CPI increase of 2.6 percent for food away from home was less than the previous year. The smaller increase in the 1998 index was partly due to adjustments by restaurants and fast food establishments to the tighter labor markets. In addition, competition among restaurants and fast-food establishments remained strong in 1998 with lower costs for raw materials, especially food, contributing to a smaller index increase.

A discussion of some individual categories of the CPI for food can help explain price changes in 1998 and expected changes in 1999. In summarizing 1998 food price increases, large consumer demand coupled with stagnant milk production contributed to higher retail prices for dairy products, especially high butterfat items; reduced fresh fruit and vegetable supplies due to El Nino and Hurricane Mitch led to substantial retail price increases; and modest increases in the indexes for sugar and sweets, cereals and bakery products, and other foods were the result of adequate supplies and a small increase in the all items CPI index. In summarizing 1998 food price decreases, large competing supplies of meats led to retail price decreases for beef and pork; lower feed prices led to larger egg production and a drop in retail prices; and adequate coffee supplies along with competition among the soft drink producers for market share led to lower prices for these items in the nonalcoholic beverages index.

- **Beef and veal**. Commercial beef production is expected to decline 2 to 3 percent in 1999, with further reductions in 2000. Economic slowdowns in Asia and Russia resulted in worsening U.S. beef trade balance in 1998. The strong U.S. economy led to a rise in beef imports of about 11 percent in 1998 with exports growing less than 1 percent. Trade is expected to be more in balance in 1999 as world beef supplies decline, slowing U.S. imports to 3 to 4 percent. Also, U.S. beef exports are expected to rise 7 to 9 percent, largely the result of food aid programs to Russia. After falling 0.2 percent in 1998, the CPI for beef and veal is expected to increase 1 to 2 percent in 1999. Continued record large supplies of competing meats at even lower prices relative to beef will hold down large retail price increases. However, as supplies decline, retail beef prices will begin rising modestly in spring 1999.

- **Pork**. With expectations of plentiful supplies of pork and competing meats throughout 1999, pork retail prices are expected to fall another 3 to 4 percent, after falling 4.7 percent in 1998. Pork production increased 10 percent in 1998, leading to the largest per capita consumption rate increase since 1994, increasing almost 4 pounds from 1997 levels. With fractionally lower production and exports expected to increase 10 percent, per capita pork consumption in 1999 will decline slightly from 1998 levels. U.S. pork exports in 1999 are expected to be over 1.3 billion pounds, up from more than 1.2 billion pounds in 1998.

When hog prices were historically low in late 1998, concerns were raised about retail prices and why they did not drop as sharply. Different demand situations can explain why retail prices do not parallel that of hog prices. First, contractual agreements between hog producers and slaughter plants are increasingly the norm with only about 10 percent of slaughter hogs sold in the open spot markets. When the available slaughter hog supply exceeds plant capacity (e.g., fourth quarter 1998), slaughter plants lower their bid for the available supply of hogs, which sharply reduces spot market prices. Likewise, when slaughter facilities are at relatively low rates of utilization (e.g., third quarter of 1997), packers bid up hog prices sharply.

Second, pork retail prices are generally slow to react to farm price changes and generally do not fluctuate as much as producer or wholesale prices. Historically, it has been found that declines in the farm value of pork take over a year to be passed on to consumers, while increases take about 4 months. In addition, retail values don't rise at the same rate or to the same degree as farm values. For example, in 1990 the net farm value for pork increased 24 percent but the pork CPI index increased by only 14.7 percent in 1990 and 3.3 percent in 1991. Similarly, when farm values fall, retail prices tend to fall less than the pork farm values. In 1991, the net farm value for pork fell 10 percent with an additional decrease of 14 percent in 1992; but the pork CPI index declined by only 4.7 percent in 1992. More recently in 1996, when the net farm value for pork increased 27 percent, the pork CPI index increase was less, 9.9 percent in 1996 and 5.2 percent in 1997.

Retailers strive to offer a variety of meat/poultry products to consumers knowing that increased sales in one meat species comes at the expense of another. And during the holidays, retailers found that they were able to move pork without significant retail price reductions, as pork supplies met rising retail consumer demand at the price range set by retailers.

- **Other meats** increased 0.9 percent in 1998, and in 1999 prices are expected to increase up to 1 percent. Other meats are highly processed food items (hot dogs, bologna, sausages) with their price changes influenced by the general inflation rate as well as the cost of the meat inputs.

- **Poultry**. Broiler meat production for 1999 could increase to 29.4 million pounds, about 5 percent above 1998. However, 1999 turkey production is forecast to be 5.25 million pounds, fractionally below 1998. Turkey producers are recovering from 2 years of negative returns, which has held down production increases. Broiler meat exports are forecast to remain weak through much of 1999, with first-half exports expected to be 20-25 percent lower than 1998. Export prospects for U.S. poultry have become less certain due to the continuing financial crisis in many Asian countries and loss of the Russian market. As these factors continue into 1999, increases in production will likely lead to lower retail prices for much of the year, despite reduced supplies of red meat. The poultry CPI is expected to change slightly, between -1 and 1 percent, after increasing 0.3 percent in 1998.

- **Fish and seafood**. The CPI for fish and seafood was up 2.6 percent in 1998, with an expected 2 to 3 percent increase in 1999. More than 50 percent of the fish and seafood consumed in the U.S. in 1998 came from imports, with another 20 to 25 percent from U.S. farm raised production. Imports for 1998 were up, especially for salmon, shrimp, tilapia, mussels, clams, and oysters. Strength of the U.S. dollar to other currencies favors a rise in imports, especially from the Asian countries.

  The U.S. has one of the world's largest farm-raised fishing industries with year-round production. Domestic production of catfish reached record highs in 1998, about 560 million pounds, with catfish growers expected to expand through 1999. In the 1990's, U.S. per capita seafood consumption has remained flat, between 14.8 and 15.2 pounds of edible meat per year, with any increases in total domestic seafood consumption coming from population growth. However, a strong U.S. economy is expected to boost away from home food demand as people travel and eat out more. This is especially important for seafood, as a large percentage of seafood is consumed at restaurants.

- **Eggs**. After volatile egg prices in 1996, the CPI for eggs fell 1.5 percent in 1997, was down another 3.3 percent in 1998, and is expected to fall 1 to 3 percent in 1999. With table egg production expected to be about 2 percent higher in 1999, consumption is expected to increase again, to the highest level since 1988. Higher production levels and slower growth in exports led to lower retail prices in 1997 and 1998, as well as expected lower prices in 1999.

- **Dairy products**. Robust demand and stagnant milk production produced record retail prices for milk and most dairy products throughout most of 1998. Increased demand and lower feed costs should provide a strong incentive to boost milk production in 1999, however increased production may not occur until the second half of 1999. With milk production expected to increase a modest 2 percent in 1999, the milk CPI is forecast up 4 to 5 percent in 1999 after increasing 3.6 percent in 1998. Strong consumer demand for dairy items, especially gourmet ice cream, cheese, and butterfat products, is expected to continue into 1999.

- **Fats and oils** increased 3.7 percent in 1998 and are expected up another 3 to 4 percent in 1999, after increasing a modest 0.9 percent in 1997. The index increase was largely due to BLS' movement of butter from the dairy products index to the fats and oils index in 1998. Higher retail prices for butter, which accounts for 31 percent of the fats and oils index, contributed to the increase. The remaining items contained in the fats and oils index are highly processed food items, with their price changes influenced by the general inflation rate in addition to U.S. and world supplies of vegetable oils. Soybean oil is the primary oil used in the production of vegetable oil products, however the relationship between soybeans and the retail price of vegetable oils is complex. Soybean oil is a joint product with soybean meal, which is primarily used for animal feed.

- **Fresh fruits**. Reduced production of most summer 1998 stone fruits and fall 1998 pears, helped to boost retail fresh fruit prices in 1998. The 1998 U.S. apple crop, which was up

9 percent from a year ago, helped mitigate retail price increases for other fruits. In 1998, U.S. grape production declined 14 percent, the pear crop was down 12 percent, peach production fell 9 percent, apricots were down 6 percent, sweet cherry production fell 12 percent, strawberry production in the six major production states was down 7 percent, and blueberry production fell 8 percent. Production of tart cherries and cranberries was up slightly. Imports provide most of the tropical fruit supplies in the U.S., with bananas, mangoes, pineapples, and papayas the most popular.

The 1997/98 U.S. citrus crop increased 5 percent over the previous year, mostly because of a record orange crop, which was up 9 percent. However, a cold snap in California's San Joaquin Valley in December 1998 caused USDA to lower orange production estimates for 1998/99. Before the freeze, the wet and cool conditions in California along with drought conditions in the spring in Florida reduced U.S. orange production by 21 percent compared to 1997/98. After the freeze, the orange crop was forecast to be 27 percent smaller than last year's record crop of 13.9 million tons, with California's production down 49 percent. Because California produces about 80 percent of the fresh-market oranges in the U.S., retail prices for oranges are expected to increase 40 to 50 percent for the first six months of 1999. Imports from other countries, including Australia and Mexico, along with diversion of part of Florida's orange production (mostly used for juice) to the fresh market should offset some of the reduced supply from California. To offset the declines in orange juice production, some of the fresh-market California oranges damaged in the December freeze were sent for processing. Fresh market oranges from Arizona and the California desert areas will be available summer 1999.

After seasonally lower banana prices in 1998, higher retail prices are forecast for most of 1999. Tropical storm Mitch, which hit the banana growing areas of Honduras and Guatemala in November 1998, caused major damage to the crop. Historically, Honduras and Guatemala combined have supplied about 30 percent of the U.S. market for bananas. In 1999, Ecuador, Costa Rica, and Columbia, who historically have supplied 60 percent of the U.S. market, will attempt to fill the supply gaps caused by tropical storm Mitch. In 1999, the impact on retail prices should occur as early as February or March, with prices peaking in April. Retail banana prices are forecast to increase up to 15 percent in the first six months of 1999, and an additional 8 percent the last half of the year.

Higher retail prices for fresh oranges, which accounts for 20 percent of the fresh fruits index, along with expected higher prices for bananas--another 18.5 percent of the fresh fruit index, raises the price forecast for 1999. The fresh fruit index, which increased 4.3 percent in 1998, is expected to increase 7 to 8 percent in 1999 due to the expected higher prices for fresh oranges and bananas, along with steady U.S. consumer demand for fresh fruits.

- **Fresh vegetables**. El Nino-driven cold, wet weather in Florida, California, and Mexico reduced fresh-market vegetable supplies, disrupted planting and harvest windows, and raised retail prices throughout the first half of 1998. In addition, tropical storm Mitch caused wind and water damage to some central Florida vegetables in early November. As

a result, the fresh vegetable index increased 10.9 percent in 1998.

Fall acreage was down in 1998, with 2 percent fewer acres of fresh-market vegetables and melons harvested in fall 1998. Acreage of cool-season crops (lettuce, carrots, broccoli) declined 1 percent, while that of warm-season crops (tomatoes, bell peppers, snap beans) dropped 3 percent. Tropical storm Mitch damaged several of the fall-season vegetable crops in Florida, snap beans and radishes were damaged and some fields required replanting. In addition, product quality of vegetables like tomatoes and eggplant were temporarily reduced and yield potential diminished. Strong winds caused some bloom loss for tomatoes and peppers, reducing supplies and causing higher consumer prices into early 1999. Mitch also flooded cantaloup fields in Costa Rica and Honduras, which could result in higher cantaloup prices in early 1999.

Harvested acreage of 13 selected vegetables is forecast to rise 3 percent to 193,500 acres during the 1999 winter season (January-March). Adding to the large domestic supplies this winter will be imports from Mexico. Fresh-market vegetable acreage is expected to increase about 1 percent in calendar year 1999. Potato production, which increased 2 percent in 1998, is also expected to increase another 1 percent in 1999. If the weather and growing conditions in the major fresh vegetable growing areas returns to normal in 1999, the fresh vegetable index is forecast to fall 1 to 3 percent.

Processed fruits and vegetables. Production of the four leading vegetables for processing (tomatoes, sweet corn, snap beans, and green peas) was down 2 percent in 1998, after a 3 percent decline in planted acreage a year earlier. Per acre yields were below a year ago for tomatoes (down 7 percent), green peas (3 percent), and sweet corn (2 percent). Yields were higher for snap beans (up 3 percent). For 1998, wholesale prices of canned vegetables and juices averaged 1 percent above the previous year, leading to minimum pressure on retail prices. The ready availability of canned and frozen vegetables, frozen concentrate orange juice and other fruit supplies kept the CPI increase for processed fruits and vegetables to 1.7 percent in 1998, with an expected increase of 2 to 4 percent in 1999.

- **Sugar and sweets**. Domestic sugar production was up to 8.0 million tons in 1997/98 and is projected up another 3 percent in 1998/99 to 8.3 million tons. Higher sugarbeet prices and lower prices for competing crops led to acreage increases in both years. Along with higher sugar output, lower retail prices for selected sugar-related food items in 1998 increased the sugar and sweets CPI by only 1.6 percent. Although U.S. sugar consumption has grown at a rate of about 1.9 percent per year since 1985/86 and sugar use by industrial users has risen, the CPI is projected to increase a moderate 1 to 3 percent in 1999.

- **Cereal and bakery products** account for a large portion of the at home food CPI - almost 16 percent. While higher grain prices contributed to higher retail prices for selected bakery products in 1996, lower grain prices in 1997 and 1998 held the increase to 2.0 percent in 1998. Most of the costs to produce cereal and bread products are for processing and marketing, more than 90 percent in most cases, leaving the farm

ingredients a minor cost consideration. Competition for market share among the three leading breakfast cereal manufacturers led to the cereal component of this index falling 9.7 percent from 1995 to 1996, with an additional decrease of 1.4 percent from 1996 to 1997. In 1998, cereal prices increased slightly, up 1.3 percent. With strong demand for cereal and bakery products, as well as competition among producers expected to continue, the CPI for cereals and bakery products is expected to rise at a rate of 2 to 3 percent in 1999.

- **Nonalcoholic beverages**. Coffee and carbonated beverages are the two major components, accounting for 15 and 38 percent of the nonalcoholic beverages index. After increasing 3.7 percent in 1997 due primarily to higher coffee prices, the index fell 0.3 percent in 1998. Lower coffee prices and strong competition in the soft drink industry by the two major competitors continued throughout most of 1998. After increasing almost 13 percent in 1997, coffee prices fell almost 3 percent in 1998 and carbonated beverages were down 1.4 percent in 1997 and another 1 percent in 1998.

  Brazil's 1998/99 coffee harvest reached a near-record 36 million bags, a third of the world's total and 50 percent above the 1997/98 marketing year. The current large Brazilian crop is forcing other countries to cut prices, which should continue to lower prices in the U.S. Brazil is the largest producer of arabica coffee beans which are preferred for gourmet coffee blends. The U.S. imports up to 80 percent arabica beans along with 15-20 percent robustas, used mainly for soluble (instant) coffee or blended with arabicas.

  U.S. retail coffee prices have fluctuated since 1994, when Brazil experienced a major freeze to their coffee trees. Recent near-record production should lead to larger U.S. stocks and continued lower consumer prices. With coffee prices continuing to decline, along with competition in the soft drink industry, the CPI for nonalcoholic beverages is expected to moderate at a 1 to 2 percent increase.

- **Other prepared foods**. Other miscellaneous prepared foods are highly processed and are largely affected by changes in the all-items CPI. These products include frozen dinners, pizzas, and precooked frozen meats. Competition among these products and from the away from home market should continue to dampen retail price increases for items in this category. In 1998, the CPI for this category increased 2.7 percent and is expected to increase 2 to 3 percent in 1999.

Changes in Food Price Indicators
1997 through 1999

Items	Relative importance [1]	1997	Final 1998	Forecast 1999
	--Percent--	------------Percent Change------------		
All Food	100.0	2.6	2.2	2 to 3
Food Away From Home	37.1	2.8	2.6	2.5 to 3
Food at Home	62.9	2.5	1.9	2 to 2.5
Meats	10.9	3.0	-1.9	-1 to 1
Beef and Veal	4.8	1.7	-0.2	1 to 2
Pork	3.8	5.2	-4.7	-4 to -3
Other Meats	2.2	2.8	0.9	0 to 1
Poultry	3.2	2.8	0.3	-1 to 1
Fish and Seafood	2.2	2.3	2.6	2 to 3
Eggs	0.8	-1.5	-3.3	-3 to -1
Dairy products	6.8	2.4	3.6	4 to 5
Fats and Oils	1.9	0.9	3.7	3 to 4
Fruits and Vegetables	9.1	2.0	5.7	2 to 3
Fresh Fruits and Vegetables	7.0	1.7	7.3	3 to 4
Fresh Fruits	3.6	0.8	4.3	7 to 8
Fresh Vegetables	3.4	2.9	10.9	-3 to -1
Processed Fruits and Vegetables	2.1	2.4	1.7	2 to 4
Sugar and Sweets	2.5	2.9	1.6	1 to 3
Cereals and Bakery Products	10.0	2.1	2.0	2 to 3
Nonalcoholic Beverages	7.0	3.7	-0.3	1 to 2
Other Foods	8.5	3.2	2.7	2 to 3

1/ BLS estimated expenditure shares, December 1997.

SWEETENER INDUSTRY TRADE POLICY ISSUES ON THE HORIZON: DANGERS, OPPORTUNITIES

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It is a pleasure to have the opportunity to discuss with you the trade policy challenges facing the U.S. sugar industry.

The U.S. sugar industry is a highly competitive one -- both within the United States market and relative to the world market. Nonetheless, survival among the segments of the U.S. industry is predicated upon their ability to reduce costs of production in the face of flat nominal producer prices for sugar for more than a decade -- prices that are sharply lower when corrected for inflation.

Changes in the structure of our industry the past few years are well known, with growers in some areas exiting the business and others expanding production to increase efficiencies and reduce unit costs. Reforms to U.S. sugar policy in the 1996 Farm Bill, with less government intervention, higher producer risk, and still lower producer prices, both necessitated and facilitated these structural changes.

Meanwhile, our producers have always faced another, external, threat -- that of subsidized foreign sugar from the world dump market. Foreign subsidies are so extensive, and the so-called "world price" for sugar is so distorted, that the world price has averaged less than half the world average cost of producing sugar for most of the past two decades. U.S. production costs are below the world average, but neither the United States, nor any country, can produce sugar for the mere 7 cents per pound the world price has recently been running.

The global movement toward freer trade, thus, raises both opportunities and dangers for U.S. sugar producers.

The major opportunity: Eliminate foreign subsidies that prop up inefficient producers and the world price will rise to reflect the actual cost of producing sugar. American producers could compete head-to-head with foreign producers and there would be no need for a U.S. sugar policy designed to limit imports.

The biggest danger: Unilateral disarmament. If the U.S. reduces its barriers to foreign sugar *before* foreign countries dismantle their subsidies, efficient American producers will be

displaced by foreign sugar from producers who may not be any more efficient but who are subsidized by their governments.

The opportunities and dangers are manifesting themselves in a growing number of trade policy venues. I'd like to review the major ones from U.S. sugar's point of view; provide some thoughts on the uniqueness of the world sugar market, which trade negotiators must take into account; and outline the U.S. sugar industry's recommendations for future multilateral trade negotiations.

Trade Policy Venues

NAFTA. The U.S. sugar and corn sweetener industry's problems with the North American Free Trade Agreement are considerable.

* **Sugar Side Letter.** Mexico had been a net importer of sugar for a number of years prior to the inception of the NAFTA in 1994. The governments of both the United States and Mexico predicted Mexico would remain an importer for the foreseeable future. Nonetheless, the NAFTA provided Mexico with more than three times its traditional access to the U.S. sugar market during the first six years, 35 times its traditional access in years 7 - 14, and virtually unlimited access thereafter.

  These provisions were negotiated by the U.S. and Mexican governments and contained in President Clinton's NAFTA submission to the U.S. Congress, which Congress approved in November 1993. The sugar provisions, as altered from the original NAFTA text, were critical to the narrow Congressional passage of the NAFTA and were widely publicized in U.S. and Mexican press reports at that time.

  Nonetheless, Mexico is now undermining the integrity of the NAFTA by claiming the sugar provisions are somehow invalid. Mexico's attempt to rewrite history on this issue is disingenuous, at best, and appears to be backfiring. Their actions have bred deep feelings of distrust in the integrity of trade agreements among many American producers, and could have profound effects the United States' ability to negotiate future agreements.

  The stakes are high in this NAFTA dispute. At issue, basically, is whether the U.S. sugar industry or the Mexican sugar industry bears the cost of the Mexican beverage industry's inevitable conversion from sugar to corn sweeteners. The side letter limits Mexican access to the U.S. sugar market in years 2001-08 to 250,000 tons of its surplus production *excluding* sugar displaced by corn sweeteners. The original NAFTA provisions allowed Mexico to send the U.S. *all* its surplus, *including* sugar displaced by corn sweeteners.

Despite its historic net-importer status, a surge in reported production and some substitution of corn sweeteners for sugar have created a Mexican sugar surplus estimated to be about 1 million tons.

* **Mexican HFCS Duties.** The NAFTA called for a phase out of Mexican import duties on U.S. high-fructose corn syrup (HFCS). Instead, Mexico has imposed antidumping duties as high as 100% on U.S. HFCS. The United States has requested dispute panels on this issue under both the NAFTA and the World Trade Organization (WTO). Meanwhile, the high duties remain in place.

  In addition, the U.S. Trade Representative is reviewing a petition by the U.S. Corn Refiners Association, under section 301 of federal trade law, on an alleged Mexican restraint of trade agreement. Reportedly Mexican bottlers have agreed to limit the pace at which they replace sugar with corn sweetener in beverage production. On this side of the border, a restraint-of-trade agreement of this nature would have U.S. government anti-trust attorneys working furiously toward its removal.

* **Above-Quota Mexican Sugar.** Under the terms of the Uruguay Round, the U.S. second-tier, or above-quota, raw sugar import tariff has dropped gradually to 15.82 cents per pound this year, bottoming out at 15.36 cents next year. But under the NAFTA, our above-quota duty relative to Mexico is only 13.60 cents this year, and drops gradually to zero in 2008.

  In 1994, the year the NAFTA went into effect, the world raw sugar price averaged over 12 cents, and these tariff levels seemed more than adequate to shield the U.S. market from above-quota sugar. Now, however, with the world price plummeting to 7 cents, the tariff on Mexican above-quota sugar may not be enough to prevent Mexico from dumping some world-price sugar on the U.S. market.

Stuffed Molasses. Some Canadian entrepreneurs, and others, have found a way to circumvent the U.S. import quota with a high-sugar content product generally called "stuffed molasses." USDA estimates the amount of sugar extracted from this product annually to be approaching 100,000 tons. U.S. beet processors and cane refiners have appealed to the U.S. Customs Service to reclassify this molasses so that it becomes a part of the U.S. tariff-rate quota. Customs' decision has been pending for some time.

A number of foreign countries with shares of the U.S. sugar import quota -- including Australia, the Philippines, and the Caribbean Basin Initiative (CBI) Sugar Group -- have filed statements in support of the U.S. processors' and refiners' position. They argue the loophole must be closed because it is not only a threat to U.S. sugar policy but to their own economic well being.

Sunset Reviews. The Uruguay Round called for the removal, or "sunset," of anti-dumping or countervailing duties by the year 2000 unless reviews by each country revealed he need to keep the duties in place. The U.S. Department of Commerce and the U.S. International Trade Commission are currently reviewing U.S. antidumping duties against sugar and syrups from Canada, France, Belgium, and Germany, and countervailing duties against all sugar from the European Union (EU). The U.S. sugar industry supports their retention. Decisions are expected later this year.

Fast Track. Congress last year rejected legislation to restore to President Clinton his expired "fast-track" authority to negotiate trade agreements that Congress would not be permitted to amend upon consideration. The Administration is committed to regaining fast-track authority, but it remains to be seen whether similar legislation will even be brought up for a vote this year. Administration officials say that regional and multilateral negotiations continue without fast track, but there will come a point when our negotiators' credibility will be compromised by a lack of fast track authority.

In any event, negotiations do continue on a number of fronts:

NAFTA Accession. Should fast track pass, the most likely first trade agreement vote would be expansion of the NAFTA. First in line is Chile. Since Chile is a significant beet sugar producer - about 400,000 tons per year -- we are watching this closely.

FTAA. Negotiations are underway on the proposed Free Trade Area of the Americas (FTAA), stretching from Canada to Argentina, with the goal of an agreement by 2005.

There are many major sugar exporters in this region. By far the most important is Brazil, where sugar production has exploded in the past few years as alcohol subsidies have dropped. F.O. Licht estimates Brazil's sugar output this year at 18.8 million tons, up from 16 million last year, and nearly double its production of just five years ago.

Brazil's dramatic expansion in the face of plummeting world sugar prices underscores two important facts:

* The world sugar price does *not* reflect the cost of producing sugar, even among the most efficient producers;

* Changes in production in Brazil, now the world's biggest single producer, are related more to government decisions about the subsidized price of alcohol than to changes in the world market price of sugar.

The Brazilian government's "Proalcool" program -- launched during the oil crises of the 1970's -- subsidized the construction of sugarcane milling/distilling facilities to produce fuel

alcohol from sugar and facilitated the expansion of Brazil's cane production from 75 million metric tons in 1975 to 280 million tons last year. More than half that cane goes to fuel alcohol production. The effects of this long-term, massive subsidy program must be taken into account in any future regional or multilateral trade negotiations with Brazil.

WTO. The World Trade Organization replaced the General Agreement on Tariffs and Trade (GATT) as the forum for multilateral trade negotiations in 1995. The final year of the Uruguay Round of trade barrier reductions is 2000.

The United States will host a Ministerial in Seattle in November to discuss the possible launch of another multilateral trade round to continue trade liberalization beyond the Uruguay Round. All of U.S. agriculture has much at stake. Unilateral concessions made in the 1996 Farm Bill far exceeded our Uruguay Round commitments and have made U.S. agriculture more vulnerable to the continued use of subsidies by other countries. Future negotiations must be performed carefully to prevent the U.S. from becoming even more disadvantaged.

For example, in the next trade round, access to developed countries should be conditioned on developing countries' achievement *and enforcement* of higher labor and environmental standards. Such an incentive system could help ensure that the next trade round results in a race to the top, in protection of workers and the environment, rather than a race to the bottom. We have publicly supported the remarks President Clinton made in this regard last May at the WTO in Geneva.

Another concern is the Uruguay Round's formula-based approach, which called for across-the-board percentage reductions, regardless of the original level of price support, import barrier, or export subsidy. Countries with the most egregious barriers have maintained their advantage throughout the transition process. For example, if one country's price support were 40% higher than another's, and both reduced by the URA-mandated 20%, the 40% advantage would remain in place -- the playing field has been *lowered*, but not *leveled.* This rigid approach needs to be replaced with a more flexible, pragmatic one.

OECD. The Organization for Economic Cooperation and Development (OECD), based in Paris, is comprised of the world's most developed countries, and is dedicated to fostering economic progress in the developing world. The OECD supplied key market data and policy analysis for Uruguay Round negotiators and is expected to do the same for the WTO.

The OECD's work on global sugar policy has been problematic is the past and warrants close monitoring by the U.S. government and sugar industry.

APEC. The Asian Pacific Economic Cooperation (APEC) talks have begun, with the aim a huge Pacific Rim free trade area by 2010. Australia, one of the world's top sugar

exporters, will be a major player in these negotiations and has already begun surfacing sugar policies as a topic for discussion.

The Unique Characteristics of the World Sugar Market

There are a number of unique characteristics to the world sugar market, which trade negotiators must take into account in future multilateral deliberations.

World Dump Market. More than 100 countries produce sugar and the governments of all these countries intervene in their sugar markets and industries in some way. These unfair trading practices have led to the distortion in the so-called "world market" for sugar, and to a disconnect between the cost of production and prices on the world sugar market, more aptly called a "dump market." Indeed, for the period of 1984/85 through 1994/95, the most recent period for which cost of production data are available, the world average cost of producing sugar is over 18 cents, while the world dump market price averaged barely *half* that -- just a little more than 9 cents per pound raw value. (See chart, Attachment A.)

Volatility. Furthermore, its dump nature makes sugar the world's most volatile commodity market. Because it is a relatively thinly traded market, small shifts in supply or demand can cause huge changes in price.

During the period 1965-95, the average deviation from trend for raw sugar prices was nearly 50 percent, more than double the average deviation for corn and almost double that of wheat. Just in the past two decades, world sugar prices have soared above 60 cents per pound and plummeted below 3 cents per pound.

Other Factors. Aside from the highly residual and volatile nature of the world sugar price, there are a number of factors that set sugar apart from other program commodities. These unique characteristics should be taken into account before sugar is lumped in with other commodities for across-the-board policy reforms.

* **Lack of Concentration.** World grain exports are overwhelmingly dominated by a small number of developed countries, but sugar exports are far more dispersed, and dominated by developing countries. This makes the playing field among major grain exporters comparatively level and policy reform relatively less complicated than for sugar.

  The world wheat and corn markets, for example, are heavily dominated by a handful of developed-country exporters -- the United States, the European Union, Australia, and Canada are four of the top five exporters of each. The top five account for 96% of global corn exports and 91% of wheat exports.

The top five sugar exporting countries, on the other hand, account for only two-thirds of global exports and three of these are developing countries. The top 19 sugar exporters account for only 85% of the market, and 16 of these are developing countries. (See charts, Attachments B & C.)

* **Developing Country Dominance.** Developing countries account for 73% of world sugar production, and 69% of both exports and imports. Developing countries were virtually ignored in the Uruguay Round of reductions in barriers to agricultural trade, and impose far lower costs on their producers for labor and environmental protections. (See charts, Attachments D - F)

* **Grower/Processor Interdependence**. Grain, oilseed, and most other field-crop farmers harvest a product that can be sold for commercial use or stored without any further processing. Sugarbeet and sugarcane farmers harvest a product that is highly perishable and of *no commercial value* until the sugar has been extracted. Farmers cannot, therefore, grow beets or cane unless they either own, or have contracted with, a processing plant. Likewise, processors cannot function economically unless they have an optimal supply of beets or cane. This interdependence leaves the sugar industry far less flexible in responding to changes in the price of sugar or of competing crops.

* **Multi-Year Investment.** The multimillion-dollar cost of constructing a beet or cane processing plant (approximately $300 million), the need for planting, cultivating, and harvesting machinery that is unique to sugar, and the practice of extracting several harvests from one planting of sugarcane, make beet or cane planting an expensive, multiyear investment. These huge, long-term investments further reduce the sugar industry's ability to make short-term adjustments to sudden economic changes.

* **High-Value Product.** While the *gross* returns per acre of beets or cane tend to be significantly higher than for other crops, critics often ignore the high cost associated with growing these crops. Compared with growing wheat, for example, USDA statistics reveal the *total economic cost* of growing cane is nearly seven times higher, and beet is more than five times higher. With the additional cost for processing the beets and cane, sugar is really more of a high-value product than a field crop.

* **Inability to Hedge.** The 1996 Freedom to Farm Bill made American farmers far more dependent on the marketplace. Growers of grains, oilseeds, cotton, and rice can reduce their vulnerability to market swings by hedging or forward contracting on a variety of futures markets for their commodities. There is *no* futures market for beets or cane. Farmers do not market their crop and can neither make, nor take, delivery of beet or cane sugar. The hedging or forward contracting opportunities exist only for the processors -- the sellers of the sugar derived from the beets and cane. These

marketing limitations make beet and cane farmers more vulnerable than other farmers to market swings.

U.S. Sugar Industry's Trade Policy Recommendations

Shaped by our experience and by the specific failures of past agreements, the following are the ASA's recommendations for future trade negotiations:

1. Compliance with past agreements, in particular, the Uruguay Round Agreement of the WTO and the North American Free Trade Agreement, must be achieved before the United States forges any new agreements. The United States, and any other country that has surpassed its URA commitments, should be given credit for doing so before being required to make further cuts in the next trade round.

2. The United States must not reduce its support for agricultural programs, particularly for import-sensitive crops such as sugar, any further until other countries have reduced their support to our level.

3. Elimination of export subsidies, the most trade distorting of all practices, and of state trading enterprises (STE's), which were ignored previously, must be given top priority in the next trade round.

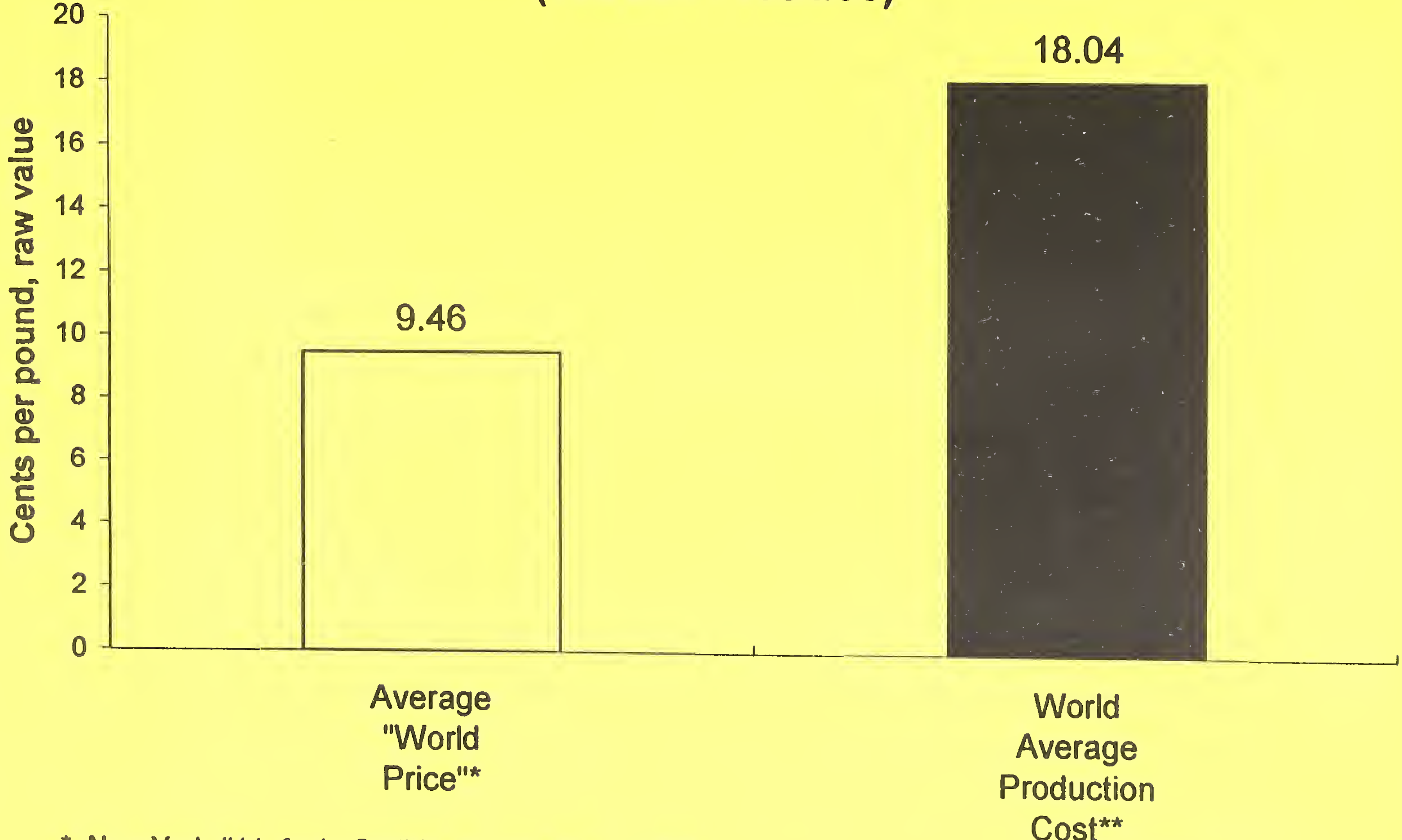
4. The wide gap in labor and environmental standards between developed and developing countries must be taken into account in the next trade round, to provide both incentives and penalties that ensure global standards rise to developed-country levels, rather than fall to developing-country levels.

5. A flexible, request/offer type of strategy must be followed in the next trade round, rather than a rigid, across-the-board, formula approach. Only in this manner can we address the huge disparities in supports among nations and turn the United States' unilateral concessions to our advantage. We must provide foreign countries the incentive to reduce their government programs by promising to reduce ours further when, and only when, they have reduced their export subsidies, internal support, import tariffs, and STE or similar practices to our levels.

forum

ATTACHMENT A

"World Price" for Sugar: Only Half World Average Cost of Producing Sugar (1984/85 - 1994/95)



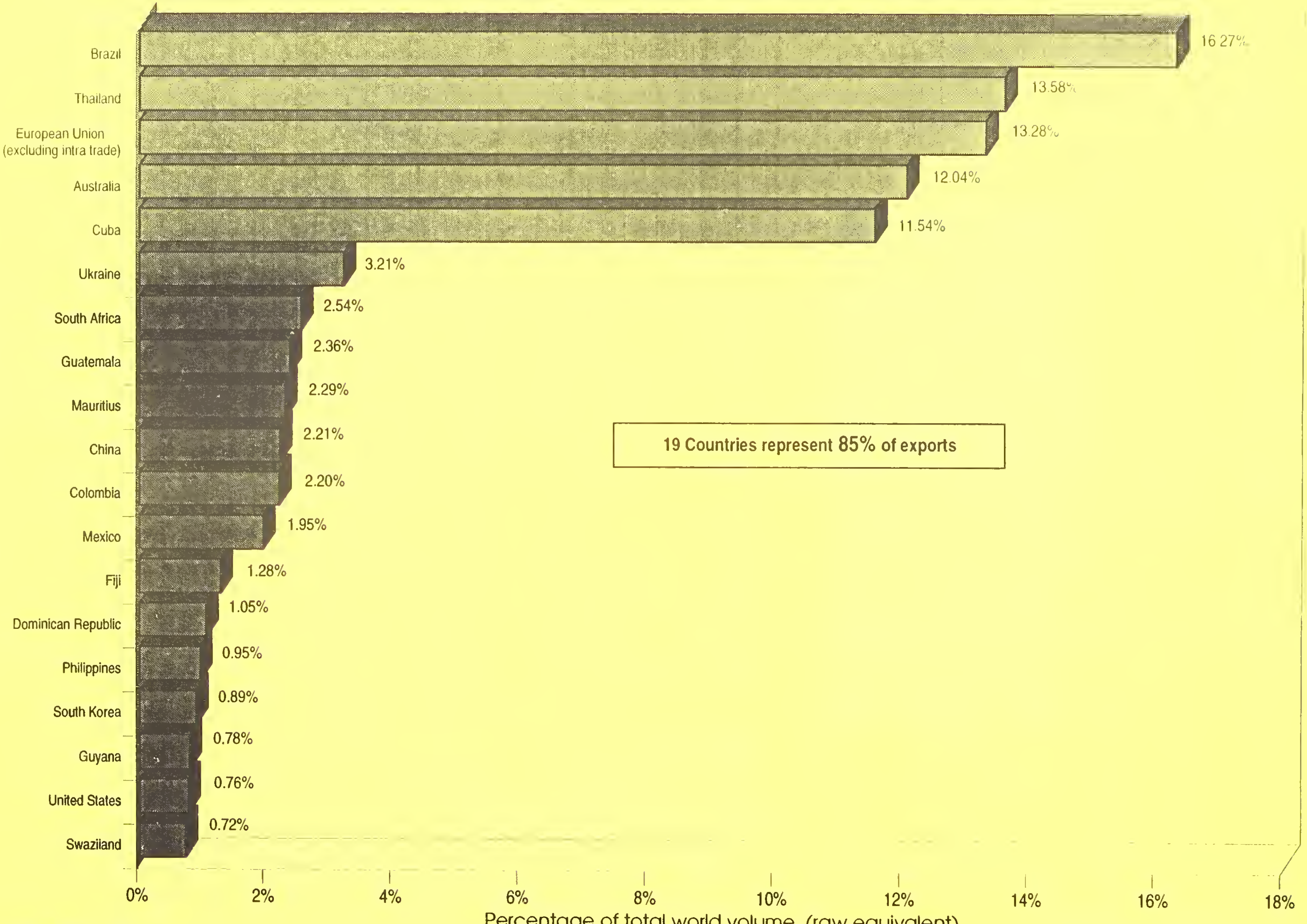
* New York #11, f.o.b. Caribbean. Source: USDA

** "A World Survey of Sugar and HFCS Field, Factory and Freight Production Costs: 1997 Report" LMC International Ltd., Oxford, England

wld$vscop2-98

ATTACHMENT B

Principal Exporters of Sugar
1996



SOURCE: FAO

103098 A G3 (french charts)

USDA 1999 Agricultural Statistics Board Calendar

January

Monday	Tuesday	Wednesday	Thursday	Friday
				HOLIDAY 1
4	Dairy Products 5	Broiler Hatchery Poultry Slaughter 6	7	Dairy Products Pr. ◆ 8
Cotton Ginnings ● 11 Crop Production	Crop Production - Ann. 12 Grain Stocks ● Rice Stocks W-Wht and Rye Seedings Egg Products	Broiler Hatchery 13	Potato Stocks 14 Turkey Hatchery Vegetables	Dairy Products Pr. ◆ 15 Milk Production Turkeys Vegetables - Ann.
HOLIDAY 18	19	Broiler Hatchery 20	Catfish Processing 21 Noncitrus Fruits and Nuts - Preliminary	Dairy Products Pr. ◆ 22 Cattle on Feed Cold Storage Livestock Slaughter
Cotton Ginnings ◆ 25	18	Broiler Hatchery 27 Peanut Stks & Processing	Layers and Egg Production - Ann. 28	Dairy Products Pr. ◆ 29 Agricultural Prices ■ Cattle Chickens and Eggs Sheep and Goats

February

Monday	Tuesday	Wednesday	Thursday	Friday
1	Poultry Slaughter 2	Broiler Hatchery 3 Catfish Production Egg Products	1	Dairy Products Pr. ◆ 5 Dairy Products
8	9	Cotton Ginnings ● 10 Crop Production Broiler Hatchery	11	Dairy Products Pr. ◆ 12 Crop Values Potato Stocks Turkey Hatchery
HOLIDAY 15	Milk Production 16	Broiler Hatchery 17	19	Dairy Products Pr. ◆ 19 Cattle on Feed Cold Storage Cold Storage - Ann. Farm Labor Livestock Slaughter
13	Chickens and Eggs 23	Broiler Hatchery 24 Catfish Processing	9	Dairy Products Pr. ◆ 26 Agricultural Prices Farms & Land in Farms Honey Peanut Stks & Processing

March

Monday	Tuesday	Wednesday	Thursday	Friday
6	Poultry Slaughter 2	Broiler Hatchery 3	Dairy Products 4 Egg Products	Dairy Products Pr. ◆ 5 Livestock Slaughter - Ann.
8	9	Broiler Hatchery 10	Crop Production ● 11	Dairy Products Pr. ◆ 12 Potato Stocks Turkey Hatchery
15	Milk Production 16	Broiler Hatchery 17	Agricultural Chemical Usage - Postharvest Applications 18	Dairy Products Pr. ◆ 19 Cattle on Feed Cold Storage Livestock Slaughter
Chickens and Eggs 22	Catfish Processing 23	Broiler Hatchery 24	Cotton Ginnings ◆ 25 Hop Stocks Wool and Mohair	Dairy Products Pr. ◆ 26 Hogs and Pigs ■
29	Agricultural Prices 30	Grain Stocks ● 31 Prospective Plantings Rice Stocks Broiler Hatchery Peanut Stks & Processing		

April

Monday	Tuesday	Wednesday	Thursday	Friday
			Dairy Products 1 Dairy Products Pr.	2
Egg Products 5 Poultry Slaughter Crop Progress	Agricultural Land Values 6	Broiler Hatchery 7	Vegetables 8	Crop Production ● 9 Dairy Products Pr.
Crop Progress 12	13	Broiler Hatchery 14 Potato Stocks	Milk Production 15 Turkey Hatchery	Dairy Products Pr. ◆ 16 Cattle on Feed
Hatchery Production - Ann. 19 Crop Progress	Cold Storage 20	Broiler Hatchery 21	Catfish Processing 22 Dairy Products - Ann.	Dairy Products Pr. ◆ 23 Chickens and Eggs Livestock Slaughter
Crop Progress 26	Floriculture Crops 27	Broiler Hatchery 28	Catfish Production 29 Poultry - Production and Value	Dairy Products Pr. ◆ 30 Agricultural Prices Peanut Stks & Processing

May

Monday	Tuesday	Wednesday	Thursday	Friday
Crop Progress 3	Dairy Products 4 Egg Products Poultry Slaughter	Broiler Hatchery 5	6	Dairy Products Pr. ◆ 7
Crop Progress 10	18	Cotton Ginnings - Ann. 12 Crop Production ● Broiler Hatchery	13	Dairy Products Pr. ◆ 14 Potato Stocks Turkey Hatchery
Milk Production 17 Crop Progress	18	Agricultural Chemical Usage - Field Crops 19 Broiler Hatchery	Catfish Processing 20	Dairy Products Pr. ◆ 21 Cattle on Feed; Cold Storage; Farm Labor; Livestock Slaughter; Meat Animals - PDI; Milk PDI
Chickens and Eggs 24 Crop Progress	6	Broiler Hatchery 26	27	Dairy Products Pr. ◆ 28 Agricultural Prices Peanut Stks & Processing
HOLIDAY 31				

June

Monday	Tuesday	Wednesday	Thursday	Friday
	Crop Progress 1	Broiler Hatchery 2	Dairy Products 3 Egg Products Poultry Slaughter	Dairy Products Pr. ◆ 4 Minn.-Wis. Base Month Price - Final 1996-98
Crop Progress 7	8	Broiler Hatchery 9	10	Crop Production ● 11 Dairy Products Pr.
Crop Progress 14	Milk Production 15 Potato Stocks	Broiler Hatchery 16 Turkey Hatchery	17	Dairy Products Pr. ◆ 18 Cattle on Feed Cold Storage
Crop Progress 21	Chickens and Eggs 22	Broiler Hatchery 23	Catfish Processing 24 Cherry Production (Tent.)	Dairy Products Pr. ◆ 25 Hogs and Pigs ■ Livestock Slaughter Peanut Stks & Processing
Crop Progress 28	Agricultural Prices 29	Acreage ● 30 Grain Stocks Broiler Hatchery		

July

Monday	Tuesday	Wednesday	Thursday	Friday
			Dairy Products 1	Dairy Products Pr. ◆ 2
HOLIDAY 5	Egg Products 6 Poultry Slaughter Crop Progress	Broiler Hatchery 7 Noncitrus Fruits and Nuts - Preliminary	Agricultural Cash Rents 8	Dairy Products Pr. ◆ 9 Vegetables
Crop Production ● 12 Crop Progress	13	Broiler Hatchery 14	Milk Production 15 Turkey Hatchery	Dairy Products Pr. ◆ 16 Cattle ■ Cattle on Feed Sheep
Crop Progress 19	Cold Storage 20 Farm Production Expenditures	Agricultural Chemical Usage - Vegetables 21 Broiler Hatchery	Mink 22	Dairy Products Pr. ◆ 23 Agricultural Prices Ann. Catfish Processing Chickens and Eggs Livestock Slaughter
Crop Progress 26	10	Broiler Hatchery 28	Peanut Stks & Processing 29	Dairy Products Pr. ◆ 30 Agricultural Prices Catfish Production

August

Monday	Tuesday	Wednesday	Thursday	Friday
Crop Progress 2	Egg Products 3	Broiler Hatchery 4	Dairy Products 5 Poultry Slaughter	Dairy Products Pr. ◆ 6
Crop Progress 9	10	Broiler Hatchery 11	Cotton Ginnings ● 12 Crop Production	Dairy Products Pr. ◆ 13 Turkey Hatchery
Milk Production 16 Crop Progress	Cranberries 17	Broiler Hatchery 18 Mushrooms	Catfish Processing 19	Dairy Products Pr. ◆ 20 Cattle on Feed Cold Storage Farm Labor Livestock Slaughter
Crop Progress 23	Chickens and Eggs 24	Broiler Hatchery 25	Turkeys 26	Dairy Products Pr. ◆ 27 Rice Stocks Peanut Stks & Processing
Crop Progress 30	Agricultural Prices 31			

September

Monday	Tuesday	Wednesday	Thursday	Friday
		Broiler Hatchery 1	2	Dairy Products Pr. ◆ 3 Dairy Products Egg Products Poultry Slaughter
HOLIDAY 6	Crop Progress 7	Broiler Hatchery 8	Vegetables 9	Cotton Ginnings ● 10 Crop Production Dairy Products Pr.
Crop Progress 13	14	Broiler Hatchery 15 Milk Production	Turkey Hatchery 16	Dairy Products Pr. ◆ 17 Cattle on Feed Hop Stocks
Cold Storage 20 Crop Progress	Chickens and Eggs 21	Broiler Hatchery 22 Potatoes	Catfish Processing 23 Citrus Fruits	Cotton Ginnings ◆ 24 Dairy Products Pr. Hogs and Pigs ■ Livestock Slaughter
Crop Progress 27	Peanut Stks & Processing 28	Agricultural Prices 29 Broiler Hatchery Trout Production	Grain Stocks ● 30 Small Grains Summary	

October

Monday	Tuesday	Wednesday	Thursday	Friday
				Dairy Products Pr. ◆ 1
Dairy Products 4 Poultry Slaughter Crop Progress	Agricultural Chemical Usage - Restricted Use Summary 5 Egg Products	Broiler Hatchery 6	Vegetables 7	Cotton Ginnings ● 8 Crop Production Dairy Products Pr.
HOLIDAY 11	Crop Progress 12	Broiler Hatchery 13	Milk Production 14	Dairy Products Pr. ◆ 15 Cattle on Feed Turkey Hatchery
Crop Progress 18	19	Broiler Hatchery 20 Cold Storage	21	Cotton Ginnings ◆ 22 Dairy Products Pr. Catfish Processing Chickens and Eggs Livestock Slaughter
Crop Progress 25	26	Broiler Hatchery 27	Catfish Production 28	Dairy Products Pr. ◆ 29 Rice Stocks Agricultural Prices Peanut Stks & Processing

November

Monday	Tuesday	Wednesday	Thursday	Friday
Crop Progress 1	8	Broiler Hatchery 3	Dairy Products 4 Egg Products Poultry Slaughter	Dairy Products Pr. ◆ 5
Crop Progress 8	6	Cotton Ginnings ● 10 Crop Production Broiler Hatchery	HOLIDAY 11	Dairy Products Pr. 12 Turkey Hatchery
Milk Production 15 Crop Progress	16	Broiler Hatchery 17	18	Dairy Products Pr. ◆ 19 Cattle on Feed Cold Storage Farm Labor Livestock Slaughter
Crop Progress 22	Catfish Processing 23 Chickens and Eggs	Cotton Ginnings ◆ 24 Broiler Hatchery Peanut Stks & Processing	HOLIDAY 25	Dairy Products Pr. 26
Crop Progress 29	Agricultural Prices 30			

December

Monday	Tuesday	Wednesday	Thursday	Friday
		Broiler Hatchery 1	2	Dairy Products Pr. ◆ 3 Dairy Products Egg Products
Poultry Slaughter 6	7	Broiler Hatchery 8	9	Cotton Ginnings ● 10 Crop Production Dairy Products Pr.
13	14	Broiler Hatchery 15 Milk Production Potato Stocks	Turkey Hatchery 16	Dairy Products Pr. ◆ 17 Cattle on Feed
Cold Storage 20	Chickens and Eggs 21	Broiler Hatchery 22	Cotton Ginnings ◆ 23 Catfish Processing Dairy Products Pr. Livestock Slaughter	HOLIDAY 24
27	Hogs and Pigs ■ 28	Broiler Hatchery 29 Peanut Stks & Processing	Agricultural Prices 30 Dairy Products Pr.	HOLIDAY 31

● 8:30 a.m. release after lockup

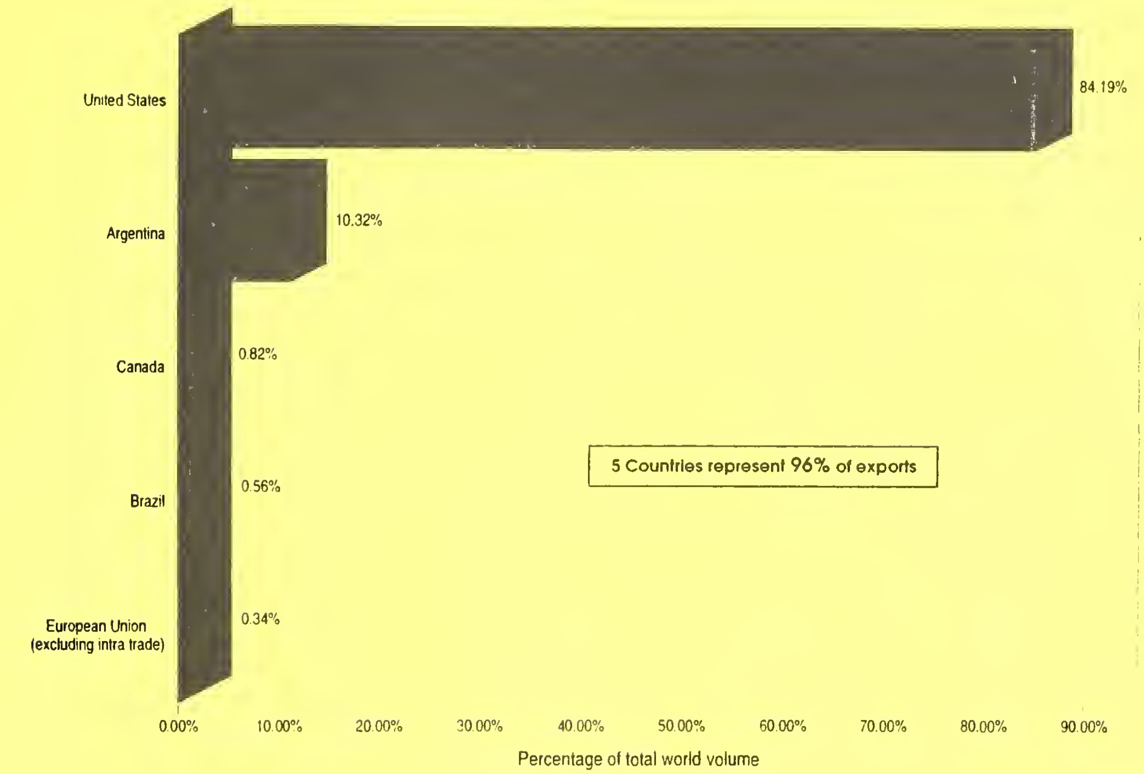
◆ 8:30 a.m. release

■ 3:00 p.m. release after lockup

Remaining reports are issued at 3 p.m. except Cranberries at 1 p.m. and Crop Progress after 4 p.m.

NASS National Agricultural Statistics Service

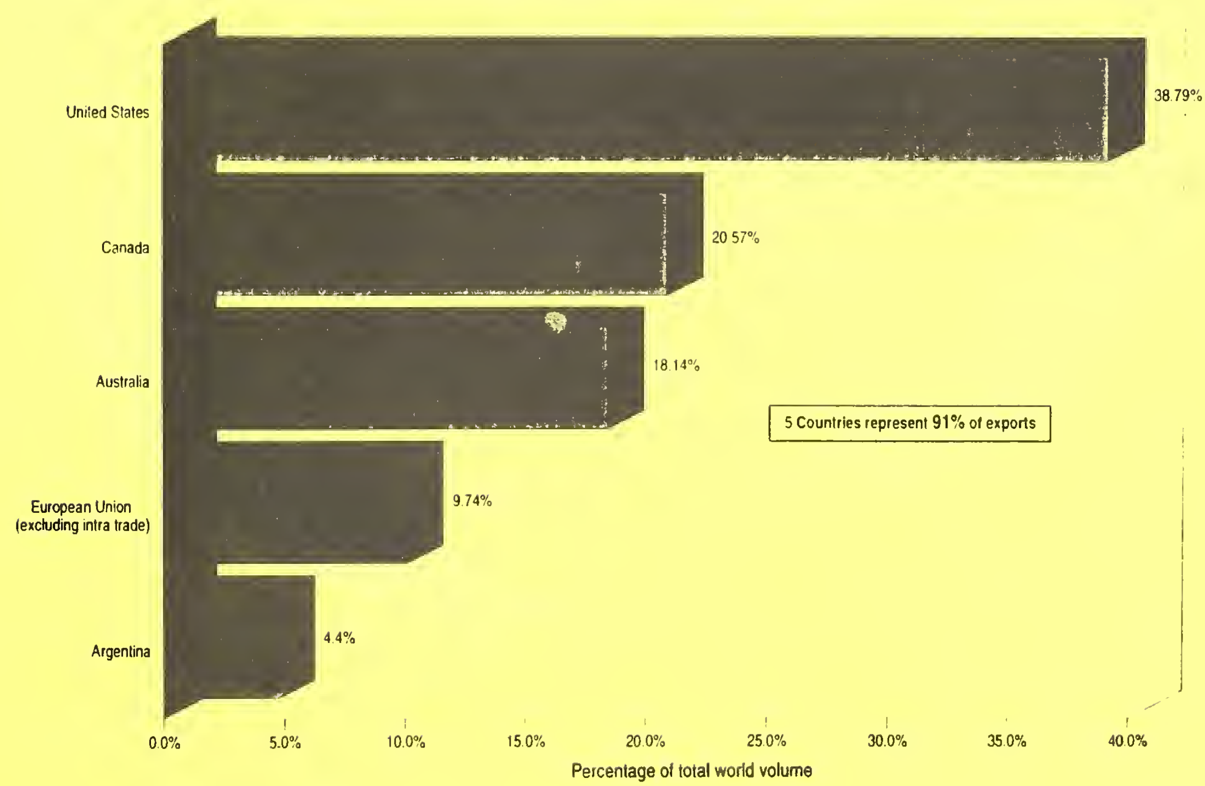
Principal Exporters of Corn
1996



SOURCE: FAO

103098 A G3 (french charts)

Principal Exporters of Wheat
1996

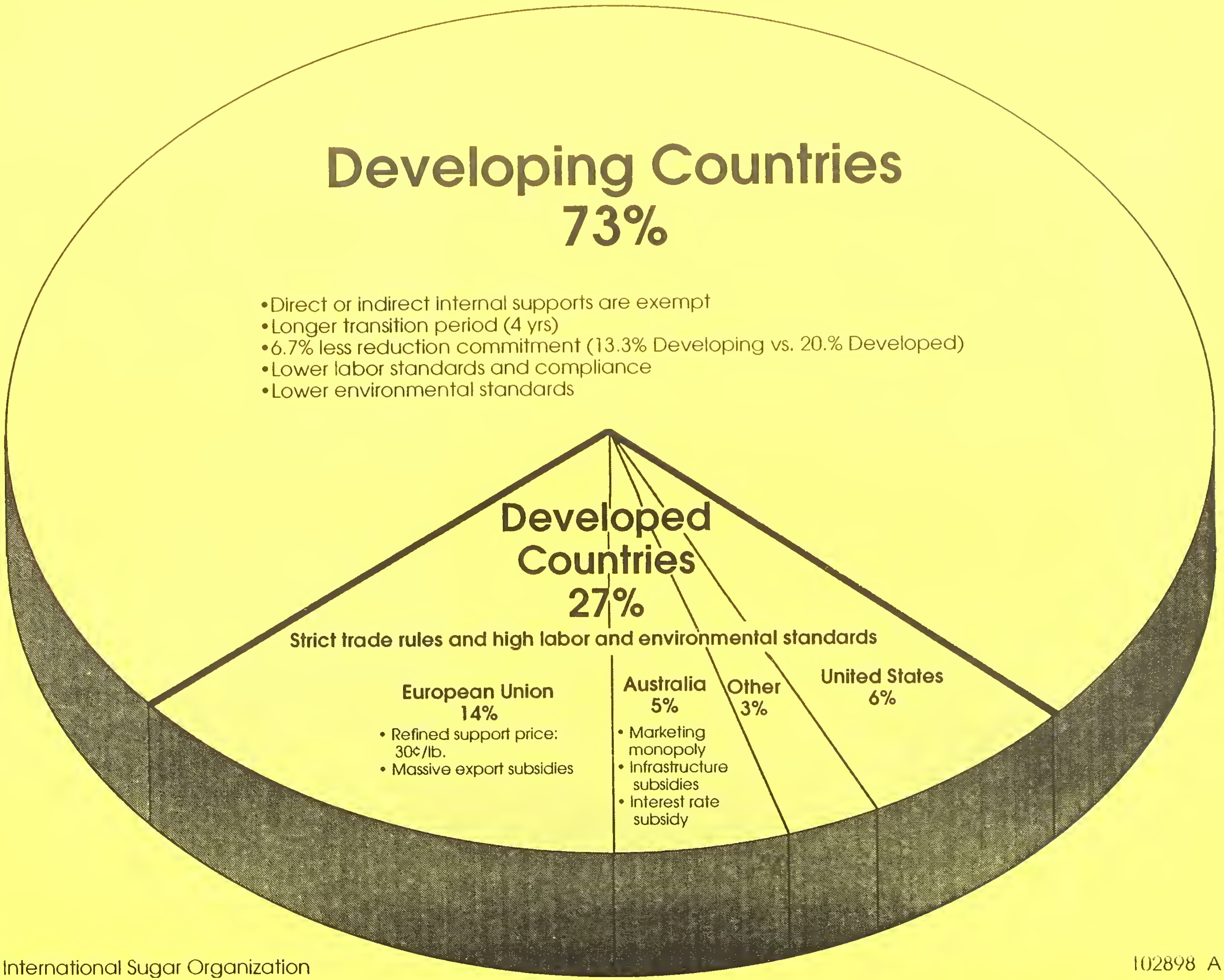


SOURCE: FAO

103098 A G3 (french charts)

ATTACHMENT D

WORLD SUGAR PRODUCTION
(3 Year Average: 1994-96)



SOURCE: International Sugar Organization

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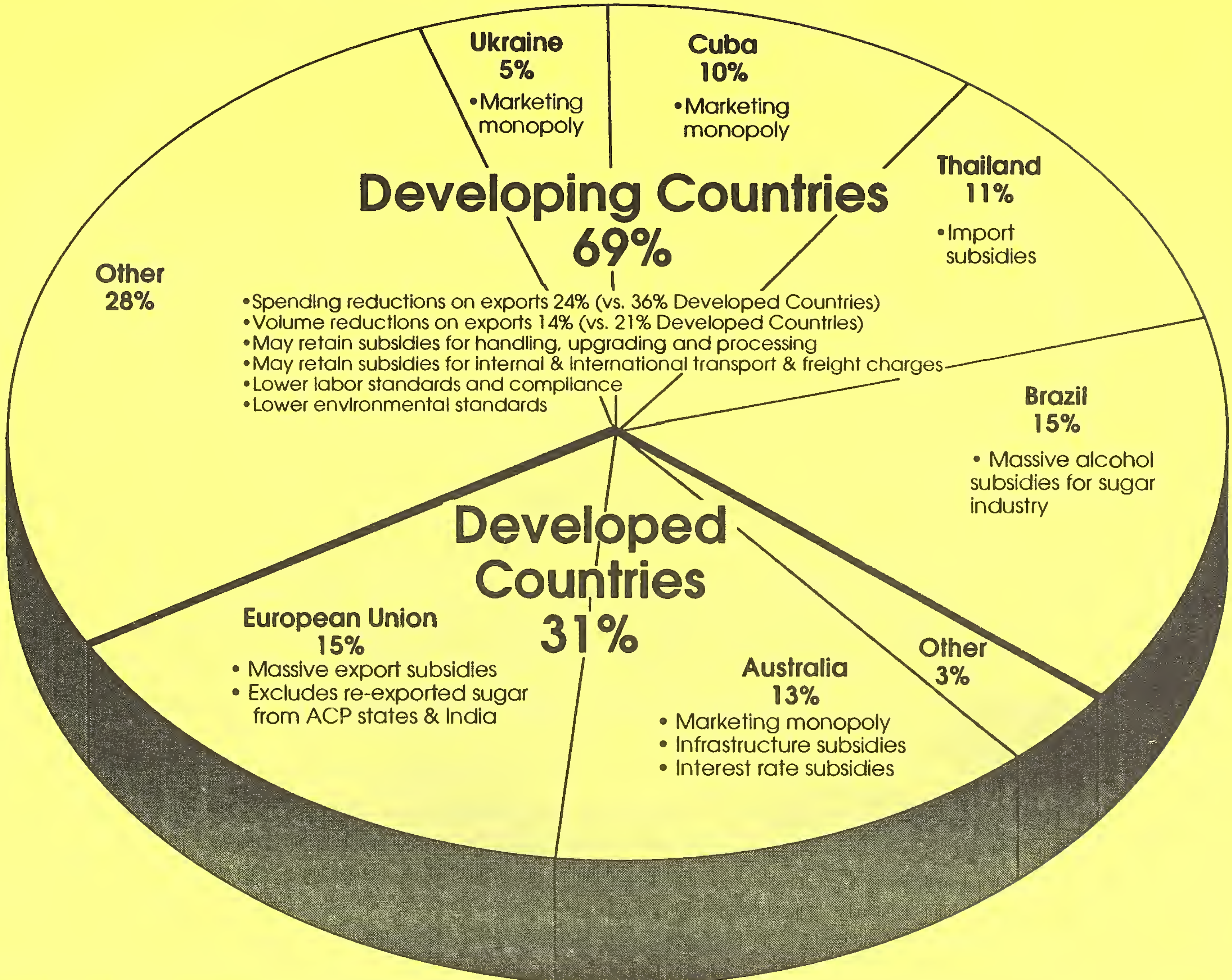
ATTACHMENT E

WORLD SUGAR EXPORTERS
(3 YEAR AVERAGE 1994-96)



SOURCE: International Sugar Organization

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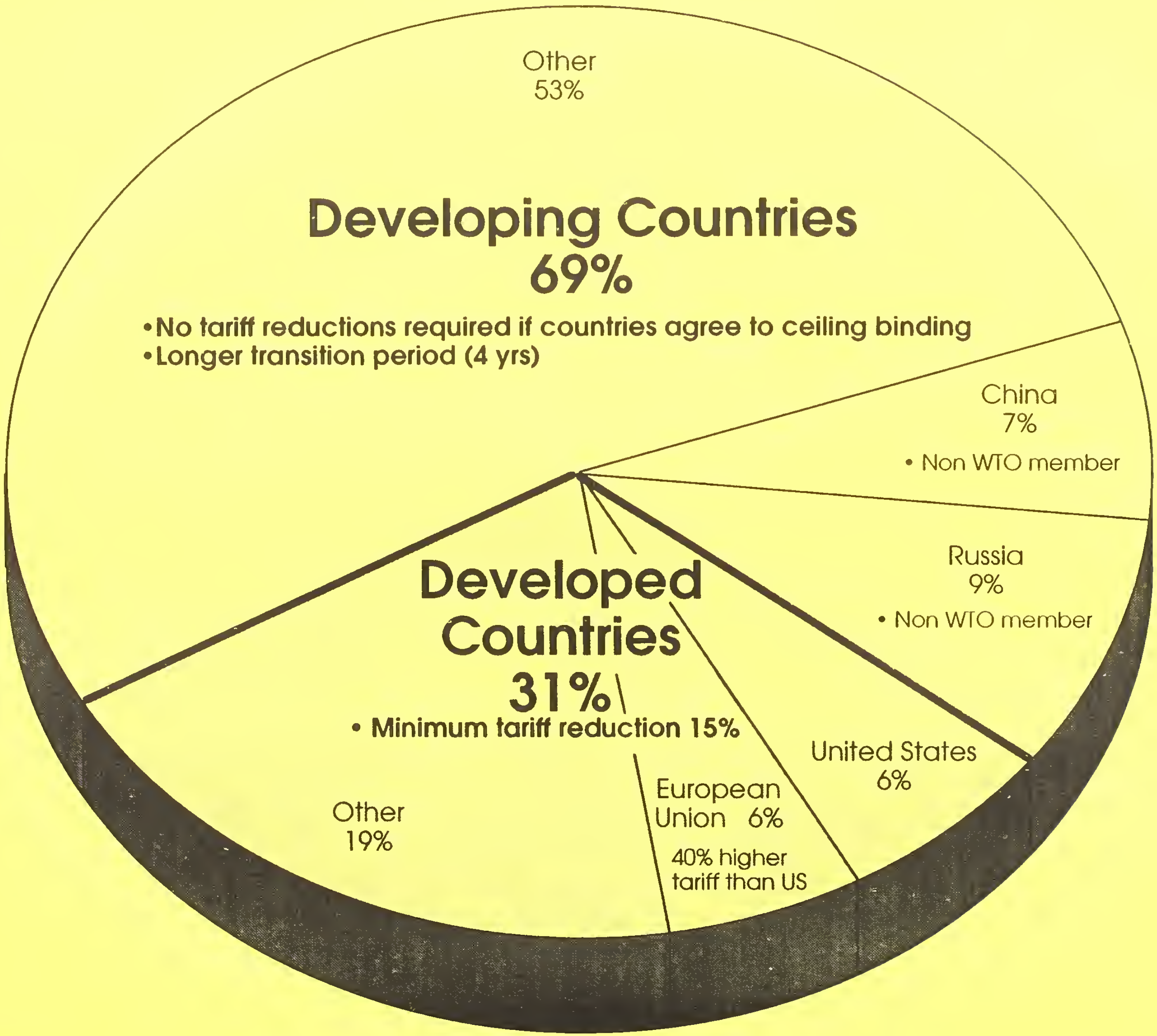
ATTACHMENT F

WORLD SUGAR IMPORTERS
(3 YEAR AVERAGE 1994-96)



SOURCE: International Sugar Organization

102898 C G3

STATE OF THE FARM ECONOMY: HOW GOOD OR HOW BAD?

Abner W. Womack, Ph.D.
Co-Director of The Food and Agricultural Policy Research Institute

Introduction. I have been in the policy analysis and long term projection business for almost 30 years. Most of the time has been devoted to establishing a funding base that permitted the development of large scale models that are global in scope. This modeling effort necessitates combining the economic and policy structures associated with planted land area, livestock production and global population into a uniform system. Long run projections are developed that serve as a base of reference for policy analysis. Currently, seven universities with about 60 researchers are devoted to this effort. At any given time a total of 5-10 Ph.D. students are involved in research projects that complement dissertation requirements. The University of Missouri and Iowa State University anchor the FAPRI Consortium with support from the University of Arkansas, Texas A&M, Arizona State, Kansas State and North Dakota State. My comments are based on the efforts of this very dedicated team of researchers - [1]the baseline analysis presented in January, 1999 at our annual Kansas City, Missouri Review. I hope my comments do sufficient justice to their efforts, however, observations expressed in this paper are solely the responsibility of the author.

Some Observations. Anyone that enters the projection game is going to make mistakes. However, the one that stands out most from all others in my mind is underestimating the potential for the expansion of global production and corresponding supply of agricultural commodities. Every time I bought the notion that global demand for agricultural commodities was going to outpace global supply with corresponding sustained increases in commodity prices, I have been wrong. So one of the first things that I do as our analysis nears completion each year, is to examine our expected price projections, contrast them to previous historical averages and evaluate differences from our last baseline. Which case won out this time. Are we entering a period of tighter supplies with higher prices or did the supply side prevail once again with lower prices? Our current baseline reflects one of the lowest price paths in recent memory and is well below levels expected in February of last year. So once again, it appears that the supply side prevails. What made this difference is the subject of our discussion today.

Why The Current Low Prices of Grains and Oilseeds? The FAPRI Team was asked this question by the House Agricultural Committee in July of 1998. Dr. Gary Adams' testimony before the committee on [2]"The Outlook for the U.S. Agricultural Economy" addressed significant contributing factors. His conclusions point in three directions. First, increases in global production fueled by expanded area and exceptionally good crops in 1996, 1997 and 1998 is the leading contender. Approximately 50 million acres of land was added to global planted area in 1996, another testimony to the responsiveness of the supply side. The calendar has to be rolled back to 1985, '86 and '87 to find three years with consecutive weather patterns that compare with the last three years. Second on the priority list was the global economic situation led by the precipitous downturn in the Asian-Pacific rim countries. Third is the FAIR Act. The new Farm

Bill released about 15 million acres of land for additional production by eliminating annual land idling.

In fairness to our modeling team, price estimates in January of 1998 were already on the decline reflecting both the expected increase in acreage and the market nature of the FAIR Act. What was not anticipated was the magnitude of the Asian financial situation and the continuation of the phenomenal weather pattern, both here and in South America. The weather pattern carries the most weight with regard to the estimated price differentials.

Our baseline projections start from a lower base than last year and hold this level for the next two to three years. There is little hope for near term optimism given the current global projections. Global economics are expected to decline over the next two to three years by about 0.5 percentage points from 1998. Taken in conjunction with the fact that baseline projections are conditioned on trend levels of technology growth and average weather, it is unlikely that current stock levels will be significantly reduced. China continues to be a major factor in the equation. There is considerably more optimism this time around with regard to China's yield growth. A reevaluation of the last two years suggests a more aggressive pace than was factored into previous analyses. This results in, for example, a net export position for corn through about 2002/03.

An additional near term caveat is weather. Holding prices at near term levels, as projected over the next two to three years, will require at least average weather in all years. Although stock levels are projected higher, they do not compare with levels carried under previous government programs. Moderate dry weather will quickly reclaim lost ground, moving prices back to longer run averages, for at least one growing season.

Longer Run Price Outlook. For some years our analysis has suggested an interesting balance between global supplies and demand of grains and oilseeds. Examination of conditioning information revealed some interesting characteristics. First, with regard to technology growth, we tended to hold a path that was at or near the rate of global population growth. Second, with expected average weather patterns this tended to suggest very little increases in crop land area. This balance generally prevailed throughout our projections unless weather problems erupted or global income demand began to exceed previous levels of expectation. So, in general, our projections suggested moderate increases in nominal prices and moderate stock reduction over time.

In the mid 1990's things began to change. There was greater excitement over the potential world income growth. Among the many questions debated was "why now?" WEFA and Project LINK financial statistics suggested that real global GDP growth averaged above 2.5 percent for the decades of the '70's, '80's and '90's. Why the sudden interest in income growth if all decades have been at or near the same level? The answer tends to be associated with the sustained (30 year) levels of income growth and the likelihood of the same in the next decade. This simply implies that a substantial number of people around the world have finally reached an income level that places greater demand on meats. As a result our analysis tended to reflect a stronger export path. And our models began to reflect increasing export demand.

Price projections tended to move above long run averages for grains and oilseeds, by the end of the 10 year horizon. Global stocks became progressively tighter and modelers scrambled to find additional land area that was required to make up the difference.

We never did join the euphoric scene about export expansion, however in both the crops and livestock models were indicating export demand growth. And our price projections were generally on the optimistic side.

Were we wrong or will this occur again? Answer, if income growth returns our models will again reflect this growth. And this is exactly what does occur in this 1999 baseline. *But, this time there is a decided difference and therefore a major turning point from previous analysis.*

This decided difference is associated in large part with a change in our assumption about technology growth. A number of countries reflect more aggressive adoption rates than previously estimated. This may well be another characteristic of the global supply potential. Higher prices in 1996 and 1997 plus concerns of food shortages seems to have fueled the supply side once again.

The resulting pace of technology expansion, particularly in places like China, Brazil and Argentina, tends to outpace the rate of global population growth, which is projected to decline over time. This leaves slack in the system unless demand strengthening can override or weather patterns begin to change for the worse.

Starting from a low price and moderate near term income growth simply shifts the entire global momentum, at least for the next three to five years to a low side price path for grains and oilseeds. Projected growth for U.S. corn yield, for example, is 1.3% per year and global yields weighted for major production regions suggest a growth rate of 1.5% per year.

The corresponding world population growth rates imbedded in the current projections suggest growth rates of 1.3% through 2002 then falling to1.2% afterwards. Developed countries are well below this average, as is China. However, developing countries that are lower on the income scale are at a faster pace of 1.6% per year led by Africa at 2.5%.

Although prices are projected lower, there will still be regions of the world with large populations that suffer from food shortages. Our models do account for these characteristics on a region or country basis. A blend of population and purchasing power sets the pace for global demand.

Table. 1

FAPRI January 1999 Baseline Projection Relative to Historical Averages			
	80-89	90-99	2000-08
Real World GDP Growth (%)	2.7	2.5	2.9
U.S. Farm Price ($1bu)			
Corn	2.45	2.38	2.28
Soybean	6.19	5.97	5.52
Wheat	3.35	3.34	3.49
Planted Area U.S. (Acres)			
Corn	75.7	70.2	80.3
Bean	64.1	64.0	70.4
Wheat	76.7	77.5	66.6
Planted Area Brazil & Argentina (Acres)			
Corn	38.4	39.9	37.4
Beans	32.0	43.0	53.1

Expected Prices. Wheat prices tend to be an exception to the price path for grains and oilseeds primarily reflecting lower planted acres and a continued strong concentration of land in the CRP. The decade of the ‘80's and ‘90's averaged about $3.35 per bushel but is expected to increase to around $3.50 per bushel in the next decade.

Soybean prices are projected to average below $6.00 per bushel ($5.52) for the next 10 years starting at a low of about $5.08 for the 1999/2000 crop and gradually increasing to around $5.90 by 2008/09. This is well below average of previous decades - almost 70 cents below the decade of the 1980's and about 50 cents below the decade of the 1990's.

The corn projected path is similar. The projected $2.30 per bushel average for the next decade is about 20 cents below the 90's estimated average and 15 cents below the average of the 80's.

This softness in world market prices of grains and oilseeds also reflects a stronger turn around in world income growth. WEFA and Project LINK projections indicate a return to stronger growth by 2001, implying strength in at least 7 out of the next 10 years.

If our technology growth assumptions used in previous baselines had been maintained it is certain that current price projections would be at higher levels.

Summary and Conclusion. Price variability continues to be a major factor in the equation. Even with the stronger production path, projected stocks-to-use ratios are well below historical levels. [3]Dr. Gary Adams of FAPRI at Missouri presented a paper at the 1998 AAEA meetings that focused on the issue of greater price variability in agriculture. He replayed previous weather patterns with stock levels more consistent with the current farm program. The drought of 1988 was buffered with about 4 billion bushels of corn stocks that resulted in a season average farm price of corn at $2.54 per bushel. Without these stock levels, the models replayed a season average price of $3.50 per bushel. If these higher prices should occur and reasonable weather returned, a two year adjustment period was necessary before prices returned to baseline levels.

Given the nature of the FAIR Act with no braking mechanism on the supply side and the fact that government stocks are no longer a part of the equation, this poses an interesting pattern for prices in the future. In the first half of the next decade, prices will tend to the low side, even with poor crop years. Short crops followed by trend level production will replenish stocks fast enough to quickly return prices to the low side. But, if the projections are correct as income growth rebuilds in the latter part of the decade stocks again appear to become tighter. The income growth component tends to catch up and starts once again to overpower the stronger technology component. Stock become continuously tighter. This makes for a different situation. Short years will hold prices higher longer, as indicated in the analysis by Dr. Adams.

But given either scenario, prices on the high side, staying longer and alternatively on the low side - staying longer, it is very likely that prices during the crop year will show spurts of quick rapid movement. Three weeks of dry weather this spring will send prices scurrying upwards. If it rains across the corn belt the next day all price strength will very likely be lost. So, even if good crops tend to prevail, the market will continue to be very nervous in streaks of dry weather.

Stated another way, my conclusion regarding price patterns in front of us is for staying power on the low side in the first half of the decade followed by staying power on the high side in the latter half. In either case we are likely to see a good deal of price movement within the crop year.

Finally, even with the likelihood of higher-highs in the latter part of the decade, this will simply speed up the rate of technology adoption which means the next cycle will move back into a lower price range. As I mentioned in my opening remarks, the supply side has staying power.

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1. The Food and Agricultural Policy Research Institute, A Summary of the FAPRI Baseline Projection, November 1998 (handout distributed at the 199 Kansas City Review, Kansas City, Missouri, January 14-15, 1999).

2. The Food and Agricultural Policy Research Institute Outlook For the U.S. Agricultural economy, (testimony offered before the House Committee on Agriculture, Washington, D.C., July 30, 1998).

3. Adams, Gary, "The Case for Greater Price Variability in Agriculture," The Food and Agricultural Policy Research Institute-UMC Report # 29-98, 8/98 (Presented at the 1998 AAEA Annual Meetings, Salt Lake City, UT).

Agricultural Outlook Forum '99 Presented: Tuesday, February 23, 1999

Supply, Demand and Trade of Agricultural Commodities in China Marketing Opportunities; World Trade Competition

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China's emergence as the world's fastest growing economy has both raised hopes that East Asia's giant can join the ranks of modernizing nations and fueled concerns that its rapid transition will upset the fragile equilibria of global markets and institutions. The nexus of China's growth, the management of its food economy, and its potential impact on world agricultural product markets compellingly illustrates the delicate balance facing policymakers. Directed properly, China's growth provides an unprecedented opportunity for achieving major gains in food security, poverty reduction, and nutritional improvement inside China. Without suitable policies, China's development may wreak havoc on sectors of its own society as well as the rest of the world.

Unfortunately, China's leadership and the international community have limited scope for understanding future trends, evaluating socio-economic tradeoffs, and sorting through policy options. Current analytical tools are quite simple, having almost no structural basis and providing little policy guidance. Predictions have been notoriously sensitive to fundamental assumptions, creating such a wide range of forecasts that policy makers have not become enlightened, but have felt defenseless when confronted with assertions on future supply, demand, and trade balances. The shallowness of understanding was exposed by the outrageous pronouncements by Brown, when he projected, without any research-based underpinnings, massive food shortfalls in China by 2030.[1] The ensuing panic in China's agricultural hierarchy, however, could not be suppressed since no research team inside or outside of China could respond authoritatively.

Predictive frameworks are not easy to construct. China is a country experiencing rapid economic and social transformation. Industrialization proceeds at one of the fastest rates in the world. These forces are causing wrenching changes: market development, urbanization, environmental degradation, and budgetary stress. These factors should be expected to have as great, if not greater, impact on supply and demand than traditional determinants such as income growth and price movements. Dealing with the challenges of managing their food sector in such a rapidly changing environment requires that China's leaders have a clear understanding of the structure of the economy, especially how supply, demand and trade are affected by any number of key economic, technological, and social forces.

The goal of this paper is to help establish a more comprehensive, transparent, and empirically sound basis for assessing the future growth of China's food supply and demand balances. We hope this paper helps shed light on the debate on China's future grain balance, identifies the kinds of structural transformations and policy decisions which might cause huge grain deficits, and shows the circumstances under which China might maintain its current status as near self sufficient.

To meet this goal, the paper first examines China's current grain balance sheet and history of grain imports, and reviews previous efforts to project China's growth of grain supply, demand, and trade. Our own assessment of the future grain economy begins by investigating a series of factors, beyond income and prices, which may affect grain demand and supply. We develop a supply and demand projections model, which includes a series of important structural factors and policy variables, including urbanization and market development on the demand side, and technology, agricultural investment, environmental trends, and institutional innovations on the supply side. After reviewing the baseline assumptions, the results of the baseline projections are presented, and alternative scenarios are examined using different rates of growth in income, prices, and wages, population, and investment in research and irrigation.

Although we limit our analysis to grain, some of the projections may be surprising. Even in this fairly homogeneous sector of China's food economy, the socio-economic forces act very differently on rice, wheat, and maize, the study's three major crops. Not only does migration, technological change, income growth, and other trends have important impacts on the future supply and demand of the commodities, under a completely reasonable set of assumptions, we can show how there could be a complete reversal in historic global trade patterns for all three grains. Whereas since 1980 China has been a net exporter of rice and maize and the world's largest importer of wheat, under our baseline scenario, we show that China could import rice and maize in the 21st century, and satisfy its own demand for wheat.

Annual Grain Production and Utilization in China

Total grain production (in trade weight) rose to 403 million metric tons (mmt) in 1993-1995 (Table 1). After decline 2 mmt in stocks (which increase current grain supply), and importing 2 mmt of grain, the total annual supply of grain during this period was 407 mmt. This supply was used to meet a number of needs: seed, animal feed, nonfood manufacturing, and direct consumption for food. Grain used for direct food consumption took up the greatest part of total supply, about 65 percent in 1993-95. Animal feed accounted for 23 percent of utilization. On a per capita basis, the average resident in China consumed 222 kilograms in a year of grain, a level quite high even in comparison to the rest of East Asia. In contrast, meat and fish consumption are relatively low. The feed supply helped provide the average resident with about 30 kilograms of meat, poultry, and fish product.

Aggregate grain balances disguise different patterns of rice, wheat, and maize utilization in terms of the use for feed and food and rural-urban dietary habits (Table 1, rows 2

to 5). China's residents consume most of the nation's rice (85 percent) and wheat (91 percent) directly as food grain. The livestock sector uses most of maize (84 percent) for feed.

Even general consumption aggregates vary by sector of the economy. Urbanites eat far less rice (68 kilograms) and more meat and poultry (34 kilograms) than their rural counterparts (103 and 20 kilograms, respectively--Table 1, rows 7 to 9). Wheat is more complex. Unlike the rest of East and Southeast Asia, China has a large wheat economy and its per capita *rural* consumption of wheat exceeds urban intake. Although there are sharp regional variations, the average rural resident consumes 90 kilograms per year of wheat versus only 72 kilograms for those in cities and towns. Commodity and sectoral differences in demand patterns become important in deriving future balances, since economic forces and structural changes affect each consumer group differently as well as the size and composition of the groups themselves.

The waxing and waning of supply and demand in the past several decades has caused imports and exports to rise and fall (Table 2). When China began its reform program in 1978, policy makers decided to allow a general increase in imports to relieve the constrained demand of consumers. Several years after import restrictions on wheat and other grains were relaxed, imports grew to nearly 15 mmt (row 2). Rapid growth of grain yields in the early 1980s reversed these trends, and by 1985 China became a net exporter. With continued demand growth in the mid-1980s, poor harvests drove net imports back up to more than 10 mmt by 1989. Soft demand and a resurgence of agricultural growth allowed imports to fall once again to the point where China was nearly self sufficient in overall grain in the early 1990s.[2] In the mid 1990s, the cycle repeated. Net imports reached historic highs of nearly 20 MMT in 1995 but are projected to decline in 1997.

Unlike aggregate imports, trends for specific commodities have been more steady. Despite a primary reliance on domestic sources, China imported more wheat than any other country in the world since the mid-1980s. Averaging 10 mmt of wheat per year means China accounts for 10 to 15 percent of world trade (Table 2, row 2). In contrast, except for 1995 and 1996 (and 1989 for rice), China has exported maize and rice (rows 3 and 4). By 1997, the recent trade patterns have returned. International traders forecast China will export more than 5 mmt of maize in 1997 and will dominate the northeast Asia maize export markets at least through.[3]

Alternative Projections of Grain Demand and Supply in China

Various attempts at projecting future trends in China's grain imports and exports have been published or are currently being used and periodically updated.[4] The most striking feature of the projections of grain surpluses and deficits is their wide range. At one extreme, China is predicted to become a net exporter of grain. CAAS forecasts that China will have the capacity to export 47 mmt in the year 2000.[5] Chen and Buckwell construct a scenario where they argue China can move from being an importer of about 10 mmt in the mid-1980s to a net exporter of 17 mmt in 2000.[6]

Other analysts believe China will eventually become a net importer of grain, some believing imports will rise gradually, others more sharply. The medium-term forecasts of the Economic Research Service of the United States Department of Agriculture (henceforth ERS) predict China will be a moderate importer through 2005.[7] Anderson, et al. predict China's grain imports will rise to 33 mmt in the early 21st century.[8]

In contrast, another set of researchers predict China's grain imports will increase significantly. Other than Brown, who predicts imports could exceed 350 MMT by 2030, Garnaut and Ma project that at per capita income growth rates of 6 to 7.2 percent (rates under those experienced between 1992 and 1994), China will require imports of between 50 to 90 mmt by 2000.[9] Carter and Zhong predict that consumption will outpace production, leaving a food balance deficit of more than 100 mmt by 2000.[10] Chen and Buckwell arrive at a high-growth scenario where China imports 59 mmt by 2000.[11]

Since all analysts are essentially forecasting from the same general base period, the predicted changes in the *relative* rates of growth of grain supply and demand lead the differences in expected grain balances.[12] Brown projects actual declines in grain production of 0.6 per cent per year (or a 20 percent decline by 2030), most of which comes from a nearly 50 percent fall in sown area.[13] Carter and Zhong project zero growth in production, while all other estimates of grain production growth are positive, ranging from 1.1 per cent to 1.8 per cent for baseline or slow growth scenarios, and to 2.9 per cent for rapid growth scenarios.[14]

Variation in demand projections is similar. Several projections of demand growth are in the range of 1.0 to 1.7 percent per year, but demand growth rates well in excess of 2 percent are projected by Garnaut and Ma and Chen and Buckwell.[15] The long term predictions from ERS predicts much higher cereal imports, a number of the alternative scenarios forecasting food balance shortfalls of 100 mmt.[16] Given the significant variation in both supply and demand projections, it is not surprising that projected net imports are widely differing. The largest import projections result from highly pessimistic supply projections (Brown; Carter and Zhong), and high-side demand projections (Garnaut and Ma; ERS).[17]

Projections by commodities are much less common. Fan, Cramer, and Wailes predict that rice exports will continue, mainly due to their assumption that demand elasticities will continue to be positive and rice production growth will continue at current levels.[18] Unpublished projections by Fan and Agcaoili and recent long range projections by the ERS forecast rising imports for wheat.[19] Their estimates, however, do not take into consideration many of the structural changes facing China's food economy.

The most difficult part of evaluating current projections results is that the sources of the parameters of the forecasting models, and forces behind the changes in important state variables (e.g., population and income growth), are not transparent. The parameters on which all of these grain projections are based (except Carter and Zhong; and Fan, Cramer, and Wailes) are either partly or wholly synthetic.[20] There also is little scope for assessing the impact of policy variables. With the exception of the ERS and Fan and Agcaoili models, no other model can be used to systematically assess the effect of policy tools that are under the

control of government. Fundamental forces in the economy, such as urbanization and market development, are ignored. Given the rapid structural change in China's economy-in-transition and the importance of policy in China, the omission of such important variables reduces the robustness of predictions from currently available models.

Structural Change and Government Intervention in China's Agriculture

As China's economy continues to change and grow, one of the main questions facing policy makers is how future patterns of utilization can most effectively be met. China is a country in rapid transition from a socialist system to one where an increasing proportion of its goods and services, including food, are being allocated by market forces.[21] It also is a country that is rapidly developing. There are many forces arising from these development and transition processes that will affect China's food economy. Any attempt to accurately forecast food future supply and demand trends must account for these major economic forces.

Demand Shifters: Income, Market Development, and Urbanization

On the demand side, recent changes in the urban economy have made urban consumers almost entirely dependent on markets for their consumption needs.[22] In this sector, prices and income changes most likely will be the fundamental force driving consumption pattern changes. Real income per capita for urban residents has risen rapidly in recent years, jumping an average of more than 5 percent annually between 1985 and 1995. At the current average level of income for most urban residents rice and wheat consumption rises very little with new increments in income; meat consumption, on the other hand, is still very much influenced by income changes.[23]

Rural residents live in a different environment than their urban counterparts, and exhibit different demand behavior. While rural incomes have grown more slowly since the mid-1980s, demand for food grains and meat products have still increased as incomes have risen.[24] The average rural consumer, however, will spend less of their additional income on rice, wheat, and other staple food grains as they become richer during the development process.

Rural consumption markets also are less complete, but as transition improves the market environment, dietary habits may change. Farmers in many areas face limited choices in their consumption decisions since many of the products they desire on a daily basis, such as meat and fresh fruit, are not always available, even as their incomes rise. In a sample of households drawn from the national household income and expenditure survey by the authors, a strong and significant correlation was found between the level of consumption of primarily purchased goods, such as meat and fruit, and the level of market development, holding income and prices constant.[25] Discontinuous free markets, lack of refrigeration, and generally high transaction costs for procuring food in rural areas affect rural consumption patterns in China. Even with rapid changes in rural markets, in 1992 China's farmers still purchased only 46 percent of their food. As markets develop, and activity on rural consumption markets increases, apart from changes in income and prices, consumption patterns will be affected.

Across Asia, as countries urbanize the behavior of consumers changes dramatically.[26] Urban dwellers consume less rice and demand higher levels of meats, milk products, and fish than their rural counterparts, even after accounting for the differences in income and prices. The ratio of urban to rural residents in China is changing fast. The urban population has grown from 19 percent of total population in 1980 to 28 percent in 1992. The impacts of this population shift on consumption in China have been documented.[27] While structural transformations of the economy should be accounted for in any predictions of future consumption patterns, few projections explicitly consider the differences in the consumption between rural and urban consumers.

The case of wheat may unfold in an unexpected pattern in China when compared to its Asian neighbors, although the dietary changes from migration will differ depending on what part of the country one is examining. Other countries in East and Southeast Asia always have experienced rising wheat demand with migration, since farmers in these countries produce and consume few wheat products.[28] Migrants from southern rice-producing areas may be expected to follow this path since their current production and consumption patterns resemble those in neighboring countries. In contrast, city-bound migrants from north China consume very high levels of wheat, about 200 kilograms per capita in many northern province, levels that exceed or approach those of traditional wheat-producing, bread-eating nations, such as Pakistan, Turkey and Egypt. North China migrants will cut their consumption of wheat dramatically as they adopt the dietary patterns of urban dwellers. Since the nation's average rural consumption level exceeds that of urban areas (Table 1), if the same magnitude of migration occurs in both North and South, China's future migration most likely will have a dampening net effect on wheat demand, unlike its other urbanizing Asian neighbors.[29]

Supply Shifters: Technology, Investment, and Environmental Stress

On the supply side, many sharp transitions are also underway. Above all, technological change needs to be considered explicitly, since it has been the engine of China's agricultural economy.[30] China's technological base grew rapidly during both the pre-reform and reform periods. For example, hybrid rice, a breakthrough pioneered by Chinese rice scientists in the 1970s, increased yields significantly in many parts of the country, and rapidly spread to nearly one-half of China's rice area by 1990.[31] Wheat and maize enjoyed similar technological transformations.[32] China's robust growth in the stock of research capital has been significantly responsible for these dramatic changes. Recent work has shown that the contribution of technology to crop growth equaled or exceeded that of the Household Responsibility System in the early reform period. Technological change contributed almost all crop growth in the late 1980s and early 1990s.[33]

There is concern, however, that China's system maybe suffering from neglect after more than a decade of reform.[34] Real annual expenditures on agricultural research fell between 1985 and 1990, before resuming real growth in 1990.[35] The slowdown in growth in annual investments in the late 1980s will result in slower growth in the overall stock of research in the 1990s and may affect production.

Historic patterns of research spending and China's investment plans affect how supply of rice, wheat, and maize will respond to research expenditures in the future. Agricultural planners have traditionally invested most heavily in rice, wheat, and maize research.[36] Technological breakthroughs and greater extension efforts in rice and wheat have pushed yields closer to their frontiers than in the case of maize. Interviews with breeders from multinational seed corporations commonly reveal that the yield potential in all crops still exists, including rice and wheat, but that it is higher in maize.

A number of other factors similarly will affect future supply. Investment in agricultural infrastructure, especially irrigation, is another important determinant of China's agricultural growth in recent decades.[37] Irrigation investment and the stock of facilities have followed patterns similar to those for research, falling in the early reform period before recovering in recent years. Trends in environmental degradation, including erosion, salinization, and loss of cultivated land show that there may be considerable stress being put on the agricultural land base.[38] Erosion and salinization have increased since the 1970s, although in a somewhat erratic pattern, and these factors have affected output of rice, wheat, maize, and other agricultural products.[39]

A Framework for Forecasting China's Grain Supply and Demand

The major components of this paper's forecasting framework include a supply model for the rice, wheat, maize, other grain, and cash cropping sectors of the agricultural economy, and demand models specified separately for rural and urban consumers for rice, wheat, other grain, and 6 other animal products. Real world price projections are generated by IMPACT, a partial equilibrium global trade model developed by Rosegrant, Agcaoili, and Perez.[40]

Grain supply is assumed to respond to the crop's own-price, prices of other crops, quasi-fixed inputs, and the off-farm wage. Output also is a function of the stock of agricultural research, the stock of irrigation infrastructure, and three environmental factors--erosion, salinization, and the breakdown of the local environment.[41] The full set of results and detailed discussion of the model can be found in Huang, Rosegrant, and Rozelle.[42]

Grain Demand

Grain consumption is divided into two parts: grain that is directly consumed for food and that which is fed to animals and consumed indirectly. Direct food equations are divided into rice, wheat, and other grains.

<u>Food Grain Demand</u>. Rural and urban food grain demand are modeled separately for several reasons. Consumption patterns are inherently different between rural and urban consumers.[43] Income differentials, expenditure growth, and rates of change of population, and other demographic factors also vary dramatically between rural and urban regions. The effect of urbanization is accounted for by multiplying per capita grain projections for each sector by

the projected changes in rural and urban populations, including the anticipated flows of rural residents into the cities.

Econometrically estimated parameters also are used for this part of the analysis. Using an Almost Ideal Demand System framework and household survey data, the authors estimated the demand parameters.[44] The estimated coefficients and elasticities are discussed in detail in two articles by Huang and Rozelle, and one by Huang and Bouis.[45] Expenditure elasticities are estimated so that they may vary according to the level of income. As projected incomes rise throughout the projection period, income elasticities fall. Urban food grain income elasticities become zero in 2000 and turn negative in 2010; those for rural residents become zero in 2010.

Feed Grain Demand. Indirect grain consumption is imputed from the underlying demand equations for pork, beef and mutton, chicken, fish, eggs, and milk. Demand parameters for the products are estimated for rural and urban residents.[46] Different sets of parameters are estimated for different types of cities. These estimates are used for the first 10 years of the projection period. Following the experience of the rest of Asia, it is assumed that after 10 years the income-demand relationship for meat by rural residents will be similar to the current expenditure pattern of small town residents. Similarly, during the first decade of next century, demand patterns of urban consumers in small- and medium-sized cities will become more like those of consumers in super cities in the 1990s.

Once the demand for meat and other animal products are known, the implied feed demand (and hence the overall demand for grain) is calculated by applying a set of feed conversion ratios.[47] The feeding efficiency of hogs is expected to increase slightly over time. Meat production is assumed to be produced in China, and to be sufficient to satisfy the demand for animal products, an assumption that is relaxed later in the analysis.

Baseline Assumptions

All simulations begin from the year of 1993-1995, the base period. Base period data on production and utilization (discussed above) are three year averages centered on 1994. Summaries of demand and supply factors which potentially affect the future development of China's food situation are in Appendices 1 and 2. A complete detailing of the structural elasticities and projected demographic structure of the economy can be found in Huang, Rozelle, and Rosegrant.[48]

Demand Side Assumptions

Income growth and population growth will remain an important determinant of food balance in the future. Population growth peaked in China in the late 1960s and early 1970s. Since then, fertility rates and the natural rate of population growth have begun to fall. Relying on the United Nation's demographic predictions, the growth rate during 1995-2000, is assumed to be 1.055 percent per annum. This annual rate falls during the next two decades to 0.740 and 0.649 percent, a level that is considerably under the world's projected growth rate (about 1.70 percent), but above recent projections by China's demographers.[49] The shares of

urban population will raise from 28 percent in the base year to 31 percent by 2000 and to 45 percent in 2020.

Baseline per capita income growth rate is forecast to average about 3 percent in the rural sector and 3.5 percent in the urban sector. The recent growth rates in the late 1980s and early 1990s were substantially above this level in the urban economy (around 6-7 percent), and significantly below this in rural areas (less than 1 percent per year between 1985 and 1992). But in recent years the overheated urban growth has slowed, and since 1991, the rural economy has begun to pull out of its recession, growing at 4 percent per year. The impact of high growth rates also are simulated to check the sensitivity of the grain projections to the alternative growth assumptions. Market factors will also change over time. Price trends are projected to follow those of world prices.[50] The rate of rural market development is expected to increase at 10 percent per year.[51]

Supply Side Assumptions

The supply side assumptions are identical to those used in Rozelle, Huang, and Rosegrant and Huang, Rozelle, and Rosegrant and will not be repeated.[52] Following the discussion above, supply will respond most sharply to new technology and irrigation investment. However, annual expenditures on research declined from 1985 to 1990, and irrigation expenditures dropped from 1975 to 1985. Because of lags, these early investment dips will keep baseline projections of investment growth below historic rates in the early projection period. The recent recovery in research and irrigation investments, together with the experience of other Asian countries and China's commitment to a strong domestic grain economy, leads to the expectation that China will sustain its recent upturn in investment funding over the long run. Erosion and salinization are expected to continue to increase at a steady but slow pace.

Results of Baseline Projections

According to the analysis, per capita food grain consumption in China hit its zenith in the late 1990s. From the baseline level of 222 kilograms, food grain consumption per capita rises slightly until 2000 and falls over the remaining forecast period (Appendix 3). The average rural resident will increase food grain consumption through 2010, before reducing demand in the second decade of the next century. The ebb of per capita rural food grain demand occurs at a time when rice and wheat income elasticities, although lower than the late 1990s, are still positive. As markets develop, rural consumers have more choice, and will move away from food grains. Urban food grain consumption per capita declines over the entire projections period.

Because of the higher quality of fine grains, total rice and wheat consumption per capita will rise slightly through the year 2000 (Appendix 3). Reflecting their still positive, albeit small, income elasticities, both rural and urban consumers demand higher quantities of rice and wheat. Per capita demand for other food grains, however, falls monotonically over

the projection period. Consumption per capita of all food grains is projected to be more than 5 percent lower in 2020 than current levels.

In contrast, per capita demand for red meat is forecast to rise sharply throughout the projection period (Appendix 4). China's consumers will more than double their consumption by 2020, from 19 to 43 kilograms per capita. Rural demand will grow more slowly than overall demand, but urbanization trends will shift more people into the higher-consuming urban areas (in middle 1990s an urban resident consumed about 60 percent more red meat than his/her rural counterpart). While starting from a lower level, per capita demand for poultry and fish rise proportionally more.

The projected rise in meat, poultry, fish, and other animal product demand will stimulate aggregate feed grain demand (Appendix 5). In the baseline scenario, demand for feed grain will increase to 117 mmt by 2000, and will reach 240 mmt by 2020. This growth rate implies that feed grain as a proportion of total grain utilization will move from 23 percent in 1994 to 40 percent in 2020. The process of moving from an agricultural economy which produces grain primarily for food to one which becomes increasingly animal feed-oriented typifies rapidly developing economies.[53]

When considered with the projected population rates, the projected per capita demands for food and feed grain imply that aggregate grain demand in China will reach 449 mmt by the year 2000 (Table 3, column 1), an increase of 10 percent over the level of 1994 (407 mmt--Table 1, column 4).[54]

Although per capita food demand falls in the later projection period, total grain demand continues to increase through 2020 mainly because of population growth and the increasing importance of meat, poultry, and fish in the average diet. By the end of the forecast period, aggregate grain demand will reach 600 mmt (Table 3, column 7), nearly 50 percent higher than the initial baseline demand. During this same period, rice demand will reach 147 mmt, a rate increase of only 15 percent. The declining importance of rice as the dominant commodity in China can be seen by noting its proportion of total grain demand is projected to fall from 31 percent in 1994 to approximately 24 percent in 2020. The share of wheat falls by 4 percent (from 27 to 24 percent) during the same time period.

Baseline projections of the supply of grain shows that China's producing sector gradually falls behind the increases in demand (Table 3, columns 2, 5, and 8). Aggregate grain supply will attain 429 mmt (in trade weight) by the year 2000. Of this, rice and wheat make up about 31 percent and 25 percent, or 131 mmt and 109 mmt. This projection implies a rise in grain output of only about 6.5 percent over the 1992-94 baseline, a figure below the estimates given in recent years by MOA officials who had hoped to meet its target of 455 mmt by 2000 (or 500 mmt in nontrade weight figures).[55]

Production is expected to rise somewhat faster in the second and third decades of the forecast period. Mostly as a result of the resumption of investment in agricultural research during the forecast period, aggregate grain production is expected to reach 488 mmt in 2010,

an increase of 14 percent during the preceding 10 years. Production will reach 569 mmt by 2020, an even higher percentage increase for the decade (16.6 percent over the 2010 level).

Under the projected baseline scenario, the gap between the forecast annual growth rate of production and demand implies a rising deficit. Total grain consumption rises at 1.48 percent per year, 0.76 percent from the rise in population and 0.72 percent due to rising per capita grain demand. Nearly all of the higher per capita grain demand is from the increased demand for feed grain (it rises by 2.89 percent while aggregate demand for food is stagnant). Grain production during this period grows only 1.35 percent annually. Imports surge to 28 mmt by 2010 and remain at a similar level through 2020 (30 mmt, Table 3, row 1).

Unlike the predictions of Fan, Wailes, and Cramer or ERS, who expect China to be a net exporter in the late 1990s, this study's results show that China will need to import moderate amounts of rice in 2000 and following years (Table 3, row 2).[56] The baseline projection shows the nation consuming 3 mmt of imported rice by the end of the current decade. In fact, China is a net rice importer in 2000 under all of the alternative assumptions. While China has been a net rice exporter in the early 1990s, recent rises in rural income have removed surplus off of the domestic market and China imported rice in 1995 and 1996.

The most surprising results of the commodity projections are those for wheat. Under the baseline scenario, the initial widening gap during the late 1990s implies a rising deficit. Wheat consumption rises at about 1.60 percent annually, while production grows only by 1.30 percent. Wheat imports rise from their recent levels of about 10 mmt per year to 13 mmt in 2000 (Table 3, row 3). Wheat imports peak shortly thereafter, and fall back their current levels by 2010 and by 2020 fall to zero, implying that China will achieve self-sufficiency in wheat.

Several factors distinguish the wheat results from those of other studies. More than anything, falling wheat demand resulting from rural to urban migration and emerging rural consumption markets allows supply to catch up. Other studies, such as Fan and Agcaoili and ERS, which do not consider urbanization and market development forces, predict higher wheat imports.[57] Moreover, while there is considerable range in this study's projections for rice and even more for maize, few changes in assumptions result in predictions of China becoming a significantly larger wheat importer than it currently is. Most all major demand factors that appear to be inexorably increasing—urbanization, income growth (with zero or negative income demand elasticities), and market liberalization--push China's consumers to reduce wheat demand over the next 25 years.

The deficit of other grain (which is mostly maize), on the other hand, experiences a rapid rise, and by 2020 almost all of China's cereal import needs will be for maize (Table 3, row 4). Taste preferences for meat and rising incomes stimulate meat demand, and indirectly feed demand, to such a great extent that after maize imports begin early in the 21st century, they expand continuously even though maize supply also accelerates. Major breakthroughs in maize technology (such as adoption of varieties with BT corn genes or new foreign-bred hybrids) could delay large imports.

In fact, structural change of any type, such as unanticipated shifts in cropping patterns, could drastically alter the pattern of commodity-specific forecasts. For example, rising wages could induce farmers to give up their intensive wheat-maize rotations in North China. If relative prices favored maize over wheat, large numbers of farmers might decide to stop producing winter wheat and plant a single crop of higher yielding maize. Such a change would work against the formation of the new patterns of imports, and China could end up continuing to import wheat and export (or at least not import) maize. The same type of trade-off could happen in the Yangtse Valley in the intense rice-wheat regions.

Alternative Projections

To test the sensitivity of the results to changes in the underlying forces driving the supply and demand balances, a number of alternative scenarios are run, altering the baseline growth rates of the key variables, including income, wages, and price, population, and investment in technology. The results indicate that low population growth rates would reduce grain demand by 32 mmt in 2020 and make China into a marginal grain exporter by the end of the projection period (Table 3, rows 5). With high population growth, imports increase to 56 mmt (rows 6). Low income growth causes a decline in projected total grain demand from 601 mmt to 555 mmt, resulting in moderate exports of grain in 2020, while rapid income growth causes projected imports to nearly triple to 85 mmt (rows 7-8).

Imports rise sharply to 44 mmt if real wages increase faster (e.g., 2 percent annually) than the baseline rate (1 percent--Table 3, row 5). However, China's still has a large, still-isolated agrarian population, of which only about one-third have off-farm jobs.[58] With rising wages, the labor force slowly is becoming integrated with the rest of the economy through emerging labor markets. The enormous increase in labor that can leave rural areas should keep rapid real wage increases from taking off for at least several decades. Moreover, even if wage rates do rise fast, and labor begins flowing off the farm, farmers will replace lower labor input with capital-intensive inputs such as farm machinery and herbicides. Since these types of capital inputs are not in the structural model (because of lack of data), the 1 percent increase in wage rates should be looked on as the percentage increase rise in the wage rate over the rate of rise of the price of capital. If real wages increases (relative to the cost of capital) did approach those in Taiwan and Korea (3 percent annual growth), imports could increase to as much as 58 mmt.

Table 4 also illustrates the large impact of investment in agricultural research and irrigation on production and trade balances (rows 2-3), a result that is hardly surprising given the large contribution to supply of agricultural research and the technology it produces. Increases in the growth rate of agricultural research and irrigation investment from 3.5 percent to 4.5 percent per year transform China from an importer to exporter by early 2010. If, instead, growth in annual investment in the agricultural research system and irrigation fell only moderately, from 3.5 percent per year (as forecast under the baseline projections) to 2.5

percent, by 2020 total production would only be 514 mmt. With no change in the demand-side assumptions, imports under such a scenario would reach a level of 83 mmt.

This level of grain imports could be expected only if there was continued decline in the growth of agricultural investment, and if the government did or could not respond as imports rose to with countervailing policy measures to stimulate food production growth. Agricultural research and irrigation investments, however, have already recovered in recent years, and in the mid-1990s when grain prices rose in response to short term tightening of grain supplies, policy makers have promised and have begun delivering greater agricultural investments.[59] While most of the investments have been targeted at irrigation, improvements in the operations of research institutes have also been announced.

In addition to domestic investments, the government could also look to the international arena for technological products that would allow China time to redevelop its agricultural research system. In fact, there are currently several large international seed companies investigating the possibilities of moving into the China's market for seeds. Such moves would reduce the expected decline in grain supply, and also decrease the expected level of imports even if growth in public investments slowed. Weak intellectual property rights and tightly controlled and fractured domestic seed markets, however, remain a serious barrier to active participation by multinational technology firms in China.[60]

Production, demand, and imports, however, are insensitive to small changes in price trends, a characteristic that will affect projections of how China's entry into (or exclusion from) the World Trade Organization (WTO) will impact food balances. Output price trends do affect China's grain balances, but the effects are small. At the baseline level, for every 0.5 percent increase (decline) in the annual projected grain price trend, imports fall (rise) by 7 mmt in 2020 (Table 4, rows 6 and 7).[61] The baseline price assumption (an annual 0.5 percent world price decline as projected by both World Bank and Rosegrant, Agcaoili, and Perez), however, was chosen as the most likely to be realized for two reasons.[62] Grain prices have trended down in real terms during the entire twentieth century. Also, if China gains admittance to WTO, it politically cannot support prices at the level maintained by its East Asian neighbors. Even without WTO membership, fiscal problems in China may keep it from using high price supports. In the event that China could and decided to adopt a protectionist policy and prices rose in real terms at 0.5 (1.0) percent annually during the next 3 decades, China imports (exports) about 5mmt (7 mmt) in 2020.

Assuming a constant response of production to erosion and salinity as the level of environmental deterioration increases, slight increases in their trends (e.g., an increase of 0.2 percent per year from 0.2 to 0.4) have little impact on output (a decline of only about 4 mmt in 2020--Table 4, the last row). Extrapolating from these results, substantial impacts would not be found until the erosion and salinity rates accelerate to growth levels 5 times greater (or to 1 percent per year increases in erosion and salinity). Even at this level of environmental stress, projected grain imports in 2020 only rise to 51 mmt. Unless the impact of environmental stress is exponential, and the government is unwilling (or unable) to invest in

rectifying the adverse aspects of the deteriorating environment, these findings find Brown's pessimism is unfounded.

China has other food policy alternatives and could turn to international meat markets to satisfy its food needs, instead of importing grain as feed. China currently is a net exporter of meat, mostly to Hong Kong and Southeast Asia. If the model allowed for meat imports, China might choose to buy meat on global markets, a move that would reduce projected feed grain imports, but not total agricultural trade volume. If China imported a quantity of meat equal to 10 percent of its 2000 meat demand, grain net imports in 2020 could be reduced to 6 mmt from the baseline of 30 mmt when China relies completely on domestic sources of meat. Without good refrigeration or transportation infrastructure, however, meat imports will be constrained in the near future. In fact, many developing countries prefer to import feed grain and undertake the value-added activity in their own country. But, if high grain imports are unacceptable under China's current political doctrine, importing meat may be one way around such an ideological constraint.

Conclusions

The purpose of this paper was to examine trends in China's grain economy, review the current set of studies that project future supply and demand trends, and then, on the basis of more comprehensive and structurally sound, econometrically estimated models, explore the factors that may be behind these alternative predictions. The authors' framework includes a demand-side model that, in addition to the impacts of income and population trends (as well as income response parameters that vary as income levels rise), accounts for the effects of urbanization and the changing level of the development of rural consumption markets. The supply response model considers the impact of prices, public investment in research and irrigation, institutional change, and environmental factors.

The projections show that under the most plausible expected growth rates in the important factors (most of which are broadly consistent with the major projection models at ERS, Carter and Zhong, and Rosegrant, Agcaoili, and Perez, China's imports will rise steadily throughout the next decade.[63] By 2010, imports are expected to reach 28 mmt, respectively. Increasing imports arise mainly from the accelerating demand for meat and feed grains, as well as by the continued slowing of supply due to reduced investment in agricultural research in the late 1980s. However, after 2010, grain imports are expected to stabilize, as demand growth slows due to increasing urbanization and declining population growth rates; and supply growth is sustained with the on-going recovery of investment in agricultural research and irrigation. China's dynamic economy and rapidly changing structure may cause changes in the historic patterns of food trade. It could by in 2010, for example, that China imports rice, and that by 2020 it is self-sufficient in wheat and one of the world's largest importers of maize.

There is considerable range in the projections, however, when baseline assumptions are varied in both the short- and long-run. Different rates of agricultural investment create some of the largest differences in expected imports, but this is what should be expected from the

factor that it has the largest marginal output response. While there are a few scenarios where projected levels of imports are somewhat large, from both the view point of China's own domestic needs, and relative to the size of current world market trade, there are factors which may keep China from becoming too large of the player in world markets. First, world grain prices would certainly rise in the face of large Chinese imports, a tendency which would dampen Chinese grain demand and stimulate domestic supply. Second, there may be major foreign exchange constraints to importing such large volumes of grain--either government policy makers will not allocate foreign exchange for additional grain imports, or exchange rate movements will discourage imports. Third, limitations on the ability of China's ports and other parts of the nation's transportation and marketing infrastructure to handle large quantities of grains may constrain import levels.

Finally, and perhaps most importantly, many political economy influences may make China's leaders react to increasing grain shortages. Regardless of China's comparative advantage, government leaders have historically, and continue to be, concerned with maintaining near self-sufficient domestic agricultural production capacity. National defense, pride, and ideology will necessarily put a premium on maintaining a rough balance between domestic demand and supply.

On the basis of the results presented in this paper, it appears that China will neither empty the world grain markets, nor become a major grain exporter. It does seem likely, however, that China will become a more important player in world grain markets as an importer in the coming decades. Both potential exporters outside of China and those charged with managing China's food needs through domestic production and imports need to be ready. Exporting nations--especially those dealing with wheat (in the short run) and maize (in the long run) --will undoubtedly be the beneficiaries of these trends. If China's policy makers believe the projected level of imports are too high (either politically or because they see some other physical or economic constraint), investment strategies need to be devised in the near future because of the long lags between the period of expenditure and the time when such investments can affect production. Investment in facilities and institutions needed to handle the increased volume of incoming grain will smooth the shock of production shortfalls, and reduce the time and expense of importing grain. China's foresight in dealing with the upcoming challenge will most likely determine whether the production-demand gap turns into a major agricultural crisis, or whether it will become an opportunity to more effectively develop the nation's food economy.

Table 1. Annual Grain Production, Utilization and Per Capita Food Consumption in China, 1993-1995.

					Disposal of Available Supply					Per Capita Food Consumption[b]		
	Production	Change in Stock[a]	Net Import	Total Supply	Seed	Animal Feed	Nonfood Manu-facturing	Waste	Food	Average	Rural	Urban
				(million metric tons)						(kilograms)		
Total Grain	403	-2	2	407	17	93	16	15	264	222	242	172
Rice	126	-3	-0	128	4	7	1	4	109	93	103	68
Wheat	103	-0	8	111	3	2	2	3	101	85	90	72
Other Grain[c]	174	1	-6	167	10	84	13	8	55	44	49	32
-- Maize	105	0	-5	100	3	65	2	3	28	24	31	7
Red Meat										19	27	17
Pork										17	23	14
Poultry										4	7	3
Fish										7	14	5

Sources: Computed by authors.

Note: Rice in milled form (trade weight). Base year is average of 1993-95.

[a] A negative number indicates a decrease in stocks, which increase total grain supply.

[b] Includes direct home consumption, grain purchased and consumed outside of home, and processed foods.

[c] Includes maize, other coarse grains and soybean.

Table 2. International Trade Balance (million metric tons) of Major Agricultural Commodities in China, 1985-1996

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996[a]
Grain	3.3	1.7	-8.9	-8.2	-10.1	-7.9	-2.6	2.0	7.9	4.3	-19.7	-6.1
Wheat	-5.4	-6.1	-13.2	-14.5	-14.9	-12.5	-12.4	-10.6	-6.4	-7.2	-11.6	-5.0
Maize	6.2	5.1	2.3	3.4	3.4	2.5	7.8	10.3	11.1	8.7	-5.1	-0.4
Rice	0.8	0.6	0.5	0.4	-0.7	0.3	0.6	0.9	1.3	1.0	-1.6	-0.3
Soybean	1.1	1.1	1.4	1.3	1.2	0.9	1.1	0.5	0.3	0.8	0.1	-0.2
Other grain	0.5	1.0	0.0	1.3	0.9	0.9	0.3	0.9	-0.1	0.0	-1.6	-0.2
Cotton	0.35	0.59	0.75	0.43	-0.25	-0.25	-0.17	-0.14	0.14	-0.39	-0.72	-0.39
Sugar	-1.73	-0.91	-1.38	-3.46	-1.15	-0.56	-0.67	0.57	1.40	-0.60	-2.47	-0.18

Sources: State Statistical Bureau, *Statistical Yearbook of China*, (Beijing: China, State Statistical Bureau Press, 1995); Ministry of Foreign Trade, *China Customs Statistics*, (Beijing: Ministry of Foreign Trade Press, January to December, 1995 and January to August, 1996).

[a] Data available only for first 6 months of 1996.

Table 3. Projections of Grain Production, Demand, and Net Imports (million metric tons) under Various Scenarios with Respect to Population and Income, 2000-2020.

	2000			2010			2020		
Alternative Scenario	Demand	Production	Net Imports	Demand	Production	Net Imports	Demand	Production	Net Imports
Baseline									
Grain	449	429	20	516	488	28	600	569	30
-- Rice	134	131	3	142	141	1	147	153	-6
-- Wheat	122	109	13	133	123	10	141	141	0
-- Other grain	193	189	3	242	224	17	312	273	38
Baseline with low population growth									
Grain	**446**	**429**	**17**	**501**	**488**	**13**	**568**	**569**	**-1**
Baseline with high population growth									
Grain	**452**	**429**	**23**	**529**	**488**	**41**	**625**	**569**	**56**
Baseline with low income growth									
Grain	**441**	**429**	**12**	**494**	**488**	**6**	**555**	**569**	**-14**
Baseline with high income growth									
Grain	**458**	**429**	**29**	**542**	**488**	**53**	**655**	**569**	**85**

See Appendix 1 for assumptions on population and income growth rates.

Table 4. Sensitivity of Grain Production, Demand, and Net Imports Projections to Alternative Assumptions on Public Investment, Wages, Price Trends, and Deterioration of the Environment, 2000-2020.

Alternative Scenario	2000 Demand	2000 Production	2000 Net Imports	2010 Demand	2010 Production	2010 Net Imports	2020 Demand	2020 Production	2020 Net Imports
Baseline	449	429	20	516	488	28	600	569	30
Baseline with low rate of investment in agriculture research and irrigation	449	424	24	516	465	50	597	514	83
Baseline with high rate of investment in agriculture research and irrigation	449	431	18	518	515	3	602	631	-29
Wage growth									
-- Low (0% per year)	449	432	18	517	496	21	600	584	16
-- High (2% per year)	449	427	22	516	481	36	599	555	44
World output price impact									
-- Large (0% per year)	449	430	19	516	492	25	600	576	23
-- Small (-1%)	450	428	21	517	485	32	600	563	37
Fertilizer price growth									
-- Low (0% per year)	449	433	16	517	501	16	601	594	7
-- High (2% per year)	449	425	24	516	476	40	598	546	52
Salinity and erosion growth									
-- Low (0% per year)	449	430	19	517	491	26	600	574	26
-- High (0.4% per year)	449	428	21	516	486	31	599	565	35

See Appendix 2 for assumptions on growth rates of prices, investment and environmental variables.

Appendix 1. Assumptions on the Growth of Factors Affecting Grain Demand in China,1994-2020.

Factors	Annual Growth Rate (%)		
	Low	Baseline	High
Total Population			
1995-2000	0.933	1.055	1.165
2000-2010	0.491	0.740	0.932
2010-2020	0.374	0.649	0.844
-- Rural			
1995-2000	0.218	0.343	0.461
2000-2010	-0.515	-0.252	-0.047
2010-2020	-0.873	-0.606	-0.413
-- Urban			
1995-2000	2.633	2.750	2.842
2000-2010	2.424	2.650	2.825
2010-2020	2.158	2.450	2.658
Per Capita Real Income			
-- Rural	2.0	3.0	4.0
-- Urban	2.5	3.5	4.5
Prices			
-- Rice	-1.0	-0.5	0.0
-- Other Grain	-1.0	-0.5	0.0
-- Meat	-0.5	-0.5	-0.5
Rural Market Development			
-- 2000	0.60	0.60	0.60
-- 2010	0.70	0.70	0.70
-- 2020	0.80	0.80	0.80

Note: The shares of urban population under baseline assumption are 28, 31, 38, and 45 percent for 1995, 2000, 2010 and 2020. Population estimates are based on United Nations, *World Population Prospects, 1994 Revisions*, (New York, NY: United Nations, 1995). Output prices are based on simulation analysis performed in collaboration with the IMPACT model developed by the International Food Policy Research Institute (M. Rosegrant, M. Agcaoili, and N. Perez, "Global Food Projections to 2020: Implications for Investment" 2020 Vision Discussion Paper Series, No. 5, International Food Policy Research Institute, Washington, DC, 1995). Figures for the rural market development are index numbers for the year indicated, J. Huang and S. Rozelle, "Market Development and Food Demand in Rural China." *China Economic Review*, forthcoming.

Appendix 2. Assumptions on the Growth of Factors Affecting Grain Supply in China, 1994-2020.

	Annual Growth Rate (%)		
Factors	Low	Baseline	High
Output and Input Prices			
-- Rice	-1.0	-0.5	0.0
-- Other Grain	-1.0	-0.5	0.0
-- Fertilizer	0	1.0	2.0
Land and Labor			
-- Land opportunity cost	1.0	1.0	1.0
-- Wage	0.0	1.0	2.0
Agricultural Research Expenditure	2.5	3.5	4.5
Irrigation Expenditure	2.5	3.5	4.5
Environmental Factors			
-- Salinity	0.0	0.2	0.4
-- Erosion	0.0	0.2	0.4

Notes: Agricultural research and irrigation expenditures are extrapolated from recent trends and are adjusted based on Li Peng, 1996, "National Economy and Social Development for the Ninth Five-Year Plan and 2010 Long Term Goals," People's Press, Beijing. The "Land opportunity cost" growth rate is an extrapolations from trends State Price Bureau, "Compendium of Cost of Production Data," (Beijing: State Price Bureau Press, 1988-95). Land opportunity cost is assumed to be the return to grain cropping (total revenues) net of expenditures for labor (including own labor valued at the market wage), farm chemicals, and other cash expenses. Output price trends are based on simulation analysis performed in collaboration with the IMPACT model reported in M. Rosegrant, M. Agcaoili, and N. Perez, "Global Food Projections to 2020: Implications for Investment" 2020 Vision Discussion Paper Series, No. 5, International Food Policy Research Institute, Washington, DC, 1995. Fertilizer price trends are similar to those used by the World Bank, *Agriculture to the Year 2000,* A World Bank Country Study (Annex 2 to China: Long-term Development Issues and Options), Washington, DC, 1990. The trends in the deterioration of the environment are based on extrapolations of past trends.

Appendix 3. Projected Annual Per Capita Food Grain Consumption under Alternative Income Growth Scenarios in China, 1994-2020.

Alternative Scenario	Per Capita Food Grain Consumption (kg)			
	1994	2000	2010	2020
Base Line				
Total Grain	222	223	219	210
-- Rural	242	245	246	243
-- Urban	172	175	174	168
Rice	93	94	93	90
-- Rural	103	105	107	109
-- Urban	68	69	69	68
Wheat	85	86	87	86
-- Rural	90	92	95	95
-- Urban	72	74	76	75
Other Grain	44	42	38	34
-- Rural	49	47	44	40
-- Urban	33	31	29	25
Low Income Growth				
Total Grain		221	216	208
-- Rural		242	243	241
-- Urban		174	173	169
Rice		93	91	98
Wheat		85	86	84
Other Grain		43	39	35
High Income Growth				
Total Grain		224	221	211
-- Rural		247	249	246
-- Urban		176	174	167
Rice		95	95	92
Wheat		87	89	87
Other Grain		42	37	32

Appendix 4. Projected Annual Per Capita Consumption of Meat and Fish under Alternative Income Growth Scenarios in China, 1994-2020.

Alternative	Per Capita Meat Consumption (kg)			
Scenario	1994	2000	2010	2020
Baseline				
Red Meat	19	23	32	43
-- Rural	17	20	26	33
-- Urban	27	30	40	52
Poultry	2	3	5	8
-- Rural	1	2	3	4
-- Urban	5	6	8	12
Fish	8	10	17	28
-- Rural	5	6	9	14
-- Urban	14	18	28	43
Low Income Growth				
Red Meat		22	27	34
-- Rural		18	22	27
-- Urban		28	34	42
Poultry		3	4	6
-- Rural		2	2	3
-- Urban		5	7	9
Fish		9	14	20
-- Rural		6	8	10
-- Urban		16	22	30
High Income Growth				
Red Meat		25	36	53
-- Rural		21	30	41
-- Urban		32	46	65
Poultry		4	6	10
-- Rural		2	3	5
-- Urban		6	10	16
Fish		11	21	40
-- Rural		7	12	19
-- Urban		20	35	61

Appendix 5. Demand for Feed Grain under Alternative Population and Income Growth Scenarios in China, 1994-2020.

Alternative Scenario	Demand for Feed Grain (million metric tons)		
	2000	2010	2020
Baseline Population Growth			
-- Low Income Growth	111	147	197
-- Base Income Growth	117	166	240
-- High Income Growth	124	189	294
Low Population Growth			
-- Low Income Growth	110	143	186
-- Base Income Growth	116	161	226
-- High Income Growth	122	183	277
High Population Growth			
-- Low Income Growth	112	151	205
-- Base Income Growth	118	171	250
-- High Income Growth	125	194	308

Note: Total feed grain is 93 million metric tons in the base year (1993-95).

[1] L. Brown, "How Could China Starve the World: Its Boom is consuming Global Food Supplies." *Outlook Section, Washington Post*, August 28, 1994.

[2] An alternative explanation for the seeming contradiction of declining imports along with rising meat demand has been suggested by Fred Crook of the USDA's Economic Research Service. He believes that grain production may be underestimated by as much as 10 percent, some of which may have contributed to growing farm stocks in the 1980s that were used as feed and food in the early 1990s.

[3] Bridges Online News Service (An Associated Press Report), August 26, 1997.

[4] S. Fan and M.C.A. Agcaoili, "Why Do Projections on China's Food Supply and Demand Differ?" Environment, Production, and Technology Division Discussion Paper No. 22. International Food Policy Research Institute, Washington, DC, 1997.

[5] Chinese Academy of Agricultural Sciences (henceforth, CAAS), "Abstract of the Comprehensive Report on Study of the Development of Grain and Cash Crops Production in China." Chapter in *Study of the Development of Grain and Cash Crop Development in China--Volume 4*. CAAS, eds. Beijing, China: Chinese Academy of Agricultural Sciences, 1985.

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[8] K. Anderson, B. Dimaranan, T. Hertel, and W. Martin, "Asia-Pacific Food Markets and Trade in 2005: A Global, Economy-wide Perspective," The Australian Journal of Agricultural and Resource Economics, 41 No. 1 (1997):19-44.

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[10] C. Carter and F. Zhong, "China's Past and Future Role in the Grain Trade," *Economic Development and Cultural Change* 39 (July 1991):791-814.

[11] Chen and Buckwell.

[12] Alternatively, if the baseline starting points differ, significant variations in predictions can occur, even if the projection frameworks are alike in all other aspects. In fact, because of differences in estimates of meat consumption, one of the factors that causes the largest differences among the models is that some analysts use per capita meat production figures as a starting point for their baseline take-off point, while others use figures bases on consumption figures. Unfortunately, because of overreporting of production figures (due to double counting and local leader exaggeration) and under estimation of consumption (due to the fact that current enumeration techniques overlook much of the consumption activities that occurs outside of the household--e.g., in restaurants), production-based estimates of demand have grown to be more than 200 percent higher than those estimates based on consumption data. In a recent conference, the Post-Conference Workshop on "China's Food Economy in the 21st Century," Annual Meetings of the American Agricultural Economics Association, Toronto, July 31, 1997, the baseline level of meat demand projections was determined to be one of the single most important factors distinguishing the various predictive models.

[13] Brown.

[14] Carter and Zhong.
[15] Garnaut and Ma; Chen and Buckwell.
[16] ERS.
[17] High import projections for supply-side reasons come from Brown; Carter and Zhong; those for demand side reasons are from Garnaut and Ma; ERS.
[18] S. Fan, G. Cramer, and E. Wailes, "The Impact of Trade Liberalization on China's Rice Sector," *Agricultural Economics* 11(September 1994):71-81.
[19] Fan and Agcaoili; and ERS.
[20] Carter and Zhong; and Fan, Cramer, and Wailes.
[21] T. Sicular, "Redefining State, Plan and Market: China's Reforms in Agriculture Commerce," *China Quarterly* 143(December 1995):1020-1046; and A. Watson, "China's Agricultural Reforms: Experiences and Achievements of the Agricultural Sector in the Market Reform Process," Working Paper 94/4, Chinese Economy Research Unit, University of Adelaide, Adelaide, Australia, 1994.
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[27] Huang and Bouis.
[28] Huang and David.
[29] In general, based on a recent work by S. Rozelle, G. Li, M. Shen, H. Li, J. Giles, T. Low, “Poverty Networks, Institutions, or Education: Testing Among Competing Hypotheses on the Determinants of Migrations in China, Paper Presented on the 1997 Annual Meetings of the Association for Asian Studies, Chicago, IL, March 13-15, 1997, there are probably about equal number of migrants coming from the north as south.
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[31] J. Lin, "The Household Responsibility System Reform and the Adoption of Hybrid Rice in China." *Journal of Development Economics*. 36(1991):353-373.

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[41] Technology was measured in stock form, and was built by aggregating past government expenditures on research according to a weighting criteria suggested by P. Pardey, R. Lindner, E. Abdurachman, S. Wood, S. Fan, W. Eveleens, B. Zhang, and J. Alston, "The Economic Returns to Indonesian Rice and Soybean Research," Report Prepared by the Agency for Agricultural Research and Development (AARD) and the International Service for National Agricultural Research (ISNAR), November 1992. Irrigation stock was constructed by aggregating public expenditures on irrigation, subject to a depreciation rate of 4 percent per year, a rate used by M. Rosegrant and F. Kasryno, "Dynamic Supply Response for Indonesian Food Crops," Working Paper, International Food Policy Research Institute, Washington DC, 1994. The environmental

variables have been described and analyzed in J. Huang and S. Rozelle, "Environmental Stress and Grain Yields in China," *American Journal of Agricultural Economics* 77, No. 4 November 1995):246-256.

[42] The general supply-side parameter were first estimated in Huang, Rosegrant, and Rozelle. More recent commodity specific estimates for wheat are in Rozelle and Huang (1997); and for maize are in Huang and Rozelle (1997).

[43] H. Bouis, "Prospects for Rice/Supply Demand Balances in Asia," Working Paper, International Food Policy Research Institute, Washington DC, 1989; and Huang and David. The parameters relating demand behavior to rises in income use expenditure data instead of income due to the difficulty in comparing urban and rural income since the former includes large subsidies for housing, health care, etc. The analysis does not consider the impact of urban housing, education, and health reforms, which would have two effects on food consumption. If urban residents paid market rates for all good and services, the income effect would reduce consumption of all goods, including food. The cross price effects, however, would offset part of this drop.

[44] A. Deaton and J. Muellbauer, "An Almost Ideal Demand System," *American Economic Review* 70(1980):321-26.

[45] Huang and Rozelle, "Income, Quality, and ..., 1994; J. Huang and S. Rozelle, "Urban Life, ...," 1995; and Huang and Bouis.

[46] See F. Fuller and J. Rude, "An Approach to Policy Analysis and Projection for the Agricultural Sector of the People's Republic of China," Paper Presented at the Post-Conference Workshop on "China's Food Economy in the 21st Century," Annual Meetings of the American Agricultural Economics Association, Toronto, July 31, 1997. There is still much uncertainty about the current estimates of meat demand parameters, mainly due to data problems. In the published data, production statistics report a level of pork output that is more than twice as great as the level of pork consumption as reported in China's income and expenditure data. The discrepancy probably has a number of components. Many researchers in China believe current demand figures miss a significant part of family member consumption that occurs out of the household (e.g., dining in restaurants, etc.). It is also suspected that production figures are inflated, in part because of statistical problems (mostly a double counting problem), and in part because local official may have an incentive to overstate pork production, since unlike grain, monitoring of livestock production is much more difficult and the probability of being caught for exaggerating production numbers is minimal.

[47] Feed conversion parameters are from ERS and are consistent with estimates used by Chinese agriculturists found in handbooks used by Ministry of Agricultural officials. Officials, however, told us that they believed these rates were too high. This would mean that the demand for feed and imports are over estimated. However, commercialization of China's livestock industry is occurring rapidly, which would mean that conversion rates should increase over time (since farmers tend to feed scraps and other non-grain feed stuffs to hogs). Hence, any over-estimation in the short run should be eliminated at some point during the study period. Current research by the authors is centered on obtaining a better set of feed efficiency rates.

[48] Huang, Rozelle, and Rosegrant.

[49] The baseline assumptions for population growth rates in the three study decades implies an overall projection period population growth rate of 0.89, a level slightly higher than that assumed

by Rosegrant, Agcaoili, and Perez (0.74). There are many reasons to believe with increasing reform, the government's ability to control fertility may lessen, and future rates of population growth may be greater than the baseline rates. Rosegrant, Agcaoili and Perez use an alternative rate of 1 percent per year. In this study's high-population growth scenario, it is assumed the growth rate in the first decade is 1.413, the second, 0.932, and the third, 0.844, implying an overall study period growth rate of 1.06. In a later section, results are presented showing the sensitivity of the conclusions to the choice of population growth rates.

[50] According to J. Huang and C. David, "Price Policy and Agricultural Incentive in China," A Report Submitted to Food and Agriculture Organization of UN, FAO, Rome, 1995, while once far out of line with world agricultural prices, in recent years China's market prices have converged with those in international markets. In an initial set of runs, constant real prices were assumed. The projected growth rates in production and demand (and thus net imports of rice and other grain) were then simulated in IFPRI's IMPACT model to generate projected world prices with China entering as a significant importer. These projected world prices were then used as the baseline projections for the China projections model: world grain prices are expected to fall by 0.5 percent annually throughout the projection period. Meat prices are assumed to follow a similar trend.

In this sense, the assumption is consistent with China's entry into GATT, where in the long run Chinese producers will not be protected or taxed by border restrictions. Since China's current grain prices are nearly the same as world market ones, there is also no obvious one time effect from liberalization. The case would be different if China went the route of its prosperous East Asian neighbors, and begin to protect its producers with ever-increasing prices. Severe fiscal problems, however, most likely rule out such a strategy.

[51] Huang and Rozelle, "Market Development ...," 1997.

[52] S. Rozelle, J. Huang, and M.. Rosegrant, "How China will NOT Starve the World," *Choices* (First Quarter 1996):10-16; J. Huang, S. Rozelle, and M. Rosegrant, "Supply, Demand, and Trade in China," An IFPRI 2020 Vision Working Paper, International Food Policy Research Institute, Washington, DC, 1996.

[53] P. Yotopolous, "Middle-Income Classes and Food Crisis: The "New" Food-Feed Competition," *Economic Development and Cultural Change*, 33 (April 1985):463-484.

[54] In addition to projected food and feed demand, total grain demand also includes use of grain for seed, nonfood manufacturing, and waste. Projected values of these uses are calculated by roughly maintaining the same ratios as found in the initial year of the baseline.

[55] MOA

[56] Fan, Wailes, and Cramer; and ERS.

[57] Fan and Agcaoili; and ERS.

[58] S. Rozelle, G. Li, M. Shen, J. Giles, and T. Low.

[59] J. Huang, "Agricultural Policy and China's Agricultural Performance," Working Paper, Center for Chinese Agricultural Policy, Beijing, China, 1996.

[60] Rozelle, Pray, and Huang.

[61] Import projections are not very sensitive to changes in prices for two reasons. First, our estimated supply own-price response elasticities are small, a characteristic that is commonly found in other Asian countries where the government frequently intervenes into the agricultural decision making process. Second, on the demand side, although there are fairly large negative own-price

elasticities, positive cross price elasticities dampen the reduction (increase) in demand when prices rise (fall). Similar magnitudes are observed with changes for the price of fertilizer; by increasing (decreasing) the projected growth of fertilizer prices by 1 percent, imports increase (decrease) by 4 MMT. Hence, if the past trends hold--i.e., falling grain prices and rising fertilizer prices, the change in China's output to input price ratio means more imports will be required to meet the nation's projected deficit (at least through the medium run when higher imports would force prices up, offsetting part of the deteriorating output-to-fertilizer price relationship.

[62] Rosegrant, Agcaoili, and Perez.

[63] ERS; Carter and Zhong; and Rosegrant, Agcaoili, and Perez.